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PHASE 3
FINAL REPORT
Assessing the Quality of Existing Soil Survey Data on Wyoming BLM Land

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Approach

The evaluation of soil surveys was focused primarily on BLM contract surveys, with a few exceptions where SCS surveys were also evaluated. This is because it is assumed that NRCS/SCS surveys were and are done to National Cooperative Soil Survey (NCSS) standards and due in part that much of the BLM land was never mapped by the Natural Resources Conservation Service/Soil Conservation Service (NRCS/SCS). Also, published NRCS surveys are not accompanied with original data needed to evaluate them. Pedon descriptions should be in National Soil Information System (NASIS) but transect data is not unless a transect point is used as a pedon description for a map unit. The exceptions to this were Sage Creek, Park County, and Big Horn County surveys. Sage Creek is an older SCS survey and was never formally published. Both Park and Big Horn County surveys were begun by the SCS but never brought to completion.

Soil surveys and their supporting documentation and maps were reviewed. Mylar sheets were reviewed and remain in the field offices. Digital data, where available, were reviewed and should be located at field offices, except where noted. We have a copy of available digital data from Carbon County, which Alex Stum used for an analysis of slope using digital elevation models. Paper copies were made of all final survey reports, field handbooks, and notes regard map unit concepts. Copies were made of most pedon description from Worland and Rock Springs Resource Areas. The immense amount of pedon data stored in the file cabinets in the Quonsett hut in the Rawlins field area were inventoried, but not photocopied. Aerial photos were reviewed, but very few were copied. The paper copies of these reports and data are stored in Boettinger's Motor Pool storage garage at Utah State University, and are available for transfer to BLM upon request.

Soil surveys in the Rock Springs, Rawlins, and Worland Resource Areas were subject to a numerical evaluation that resulted in scores for data quality and overall quality (Table 1). The Excel files used to record data and calculate scoring are included in Appendix A at the end of this report. A table (Table 1) and an index map of all surveys scored (Figure 1), the map illustrating data quality scores (Figure 2), and the map illustrating overall quality scores (Figure 3) are included at the end of this report. Summaries and inventories of these data are included in Appendix A (Scoring sheets for individual soil surveys) and Appendix B (Notes on individual soil surveys). Specific recommendations for improving existing surveys are offered near the end of this report.

Transcriptions of notes that accompanied soil surveys, summaries of important information and evaluative notes for each survey in the Rock Springs, Rawlins, and Worland Field areas, and some correspondence are included in Appendix B and Appendix C at the end of this report. A complete record of all e-mail correspondence related to this project has been archived electronically at Utah State University, and is available upon request.

Summary of Findings

Newcastle Resource Area

It appears that Newcastle Resource Area (NRA) uses existing SCS/NRCS soil survey data. Before all surveys were completed and publicly available, Eldon Allison (geologist at the time) as part of a Unit Resource Analysis (URA) for the original NRA Management Framework plan in 1979 created Mylar overlays that have "major soil taxonomic class boundaries, linked to map unit symbol" for Weston, Crook, and Niobrara Counties. It is believed that most of Allison's data originated from the SCS and no field work was done. This information was obtained per conversation and e-mail exchange with Rod Randall. A visit to Newcastle was deemed unnecessary because SCS/NRCS surveys covered the resource area and there appeared to be no other soil survey data.

There are published NRCS/SCS soil surveys that cover most of Weston (1990) and Crook (1983) Counties. More recently, (2003) the Niobrara County survey was published. As of October 2001, Crook, Niobrara, and Weston Counties were digitized SSURGO.

Buffalo Resource Area

The Buffalo Resource Area is nearing completion of all its soil survey areas. North and South Campbell County soil surveys are pending publication. Sheridan (1998) and Southern Johnson (1975) Counties are both digitized SSURGO soil surveys. Currently the NRCS and BLM are working in cooperation to complete Northern Johnson County. This is where Nephi Cole is applying his model, Pedogenic Understanding Raster Based Classification (PURC), using GIS and remote sensing technologies to accelerate soil mapping as Phase I of this project.

Casper Resource Area

The Casper Resource Area will be completely mapped when the pending Southern Converse County survey is published/digitized. Southern Goshen (1971), Platte (2003), Northern Converse (1988), and Natrona (1997) Counties are all digitized SSURGO surveys. Northern Goshen County (1981) is not yet digitized.

Rawlins Resource Area

Rawlins Resource Area covers Albany, Carbon, Laramie and the eastern third of Sweetwater Counties. Albany County (1998) and Laramie Eastern (1983) and Laramie Western (2002) Counties all have NRCS/SCS surveys and are digitized SSURGO soil surveys. The rest of the area is a conglomeration of smaller surveys and areas that appear to have never been mapped. Most of these surveys were begun or completed in the late 1970s and early 1980s. These surveys were carried out by four soil survey teams: BLM, SCS, and two contract teams (TRC and SaLUT). The exceptions to this are Sage Creek, which was done earlier in the 1970s by the SCS, and Seven Lakes, which also appears to have been done earlier.

According to Richard Larsen there was little coordination, correlation, and cooperation between the SCS and BLM with the two contract teams. He also pointed out that the National Soil Survey Handbook recommends that there be only one party leader for consistency. There is also a lack of supporting data, and what data there are in some cases is poor. While the BLM attempted to fix some of these problems, these surveys do not appear to meet NCSS standards but are useable. Susan Foley also mentioned that there are problems with edge matching and has encountered soils that were not what they were described to be.

These surveys do use the same mapping unit legend, again with exception of Sage Creek and Seven Lakes which have their own legends. A problem that resulted from the cookie cutter pattern of surveys was that:

> Some soil map units used by one survey party could have been mapped by another party but weren't. This is because, not enough acreage was found by one survey party for use. As a result these low acreage units were lumped with other map units of more extensive acreage; even though there was enough acreage of the unit in the Divide Resource area as a whole (Richard Larsen).

Most of the raw documentation and information by Richard Larsen, Steve Howell and company was found in a filing cabinet stored in the Quonset hut at Rawlins. We recommend that their preservation and storage be improved.

Shirley Basin

This is a BLM survey that was started in 1982. This survey covers over 1 million acres of northeast Carbon County. It appears that it never was brought to completion. It scored very low with attributes and documentation due to the map unit descriptions which have not been created. It has been digitized. Susan Foley also mentioned that its legend has not been updated. It does have a large number of pedon descriptions and has the potential to be a good survey if more data is gathered and map units finalized.

Seven Lakes

This survey has very little of value to it. It is an order 4 soil survey located in Northeast Sweetwater County. There were no pedon descriptions or documentation, just broad descriptions. Susan Foley also finds it to be of no use.

Overland (SaLUT & TRC)

This survey area was completed by two BLM contract survey teams. SaLUT (Soil and Land Use Technology), which is based in Columbia MD, mapped 1,100,000 acres in just two field seasons (1979 and 1980). SaLUT was contacted via e-mail, and responded that data are not kept more than five years following project completion. TRC (Texas Resource Consultants) appears to have mapped about the same acreage in just over one field season. Attempts to find TRC failed. Most of the notes from Richard Larsen reflect problems with these two surveys. He mentions that field checks have shown their documentation to be inaccurate and sloppy. The speed at which these surveys were completed gave very little time for the SCS to field check. It was also mentioned that their field sheets were turned in late to the SCS making their task impossible to perform. It also appears that there were some contract problems with TRC. Some excerpts from a letter to TRC are outlined in the appendix.

Sage Creek

This is a smaller SCS survey located Western Carbon County. It was never published for public distribution. It is an older survey completed in the early 1970's. The main issue that Susan Foley found with this survey was the range types (vegetation) were poorly done. It also uses an older legend and is not in common with any other surveys in the resource area. Also, do to its age many of the soils may need to be updated to conform to current taxonomy. There was only data which was present in the final report.

Smaller Surveys

Encampment is a smaller survey in Carbon County that doesn't appear to have been completed. It was worked on in 1984. It is made up of only 15 map units. Elk Mountain is another survey mentioned in the area but very little data or anything was found for the survey. Both these surveys appeared to have been started by the BLM.

Red Rim is a SCS survey completed in 1976, it covers only 12,800 acres. Beyond the published survey there is no data.

Mine Reclamation Consultants Inc., did three small surveys: China Butte Lease (16,800 acres), Atlantic Rim, and Crestone-Cherokee Lease (13,760 acres). Again little data existed for these surveys. They appear to be site-specific. Susan was also unfamiliar with these surveys.

Rock Springs Resource Area

Rock Springs was designated as our contact for gathering information for the Kemmerer, Pinedale, and Rock Springs Field offices. This area includes Sublette, Lincoln, Uinta, and western Sweetwater Counties. Most of the area was mapped through BLM contracts. There are also several surveys done by BLM Soil scientists and by the SCS/NRCS. There are three recently published NRCS soil surveys in the area: Star Valley, Eden Valley and Henry's Fork. Currently the NRCS is working to complete the Uinta and Sublette County surveys leaving Sweetwater and Lincoln Counties to be completed. There was not much raw data for a lot of the surveys completed in this area. Perhaps some of these surveys would score better if more original data were available.

Sweetwater County

The two largest surveys of this are were done by SaLUT. They are Green River and Salt Wells. Both of them are almost entirely contained in Sweetwater County. Green River was published in 1979 after 1.3 million acres were mapped in only one field season. Salt Wells also appears to have been completed in one field season in 1978. It does not specify its acreage but appears to be larger. There are no data beyond what is included with the descriptions in the survey. SaLUT was contacted via e-mail, and responded that data are not kept for more than five years following project completion. John MacDonald finds both surveys very unreliable.

Tri-Territories or Stagecoach Draw is an order 2 soil survey North of Rock Springs. It did not score well as it is not is a published format and lacked documentation for the larger scale it was mapped at. But John MacDonald found it to be accurate and a good survey.

Sublette County

The NRCS is beginning the soil survey for Sublette County this year. Phase II of this project will carried out by Amy Saunders. Previous mapping of Sublette County was done by three BLM contracts and by the BLM/SCS.

Big Piney/LeBarge survey is located in the Southwest corner of the county. It was done by ERO Resource Corporation. There is some information on the data that was collected for this survey such as a list of map units and the number of description gathered from each one. The pedon descriptions were poorly geo-referenced leading it to score poorly in the spatial data component. John MacDonald thought this survey and the Burma Road survey to the East to be pretty good surveys.

The Burma Road survey was also done by ERO Resource Corporation. It was completed in 1988 and is located East of Big Piney extending out to US. HWY 191 to the East. Its score is low due to its lack of geo-referencing, lack of transect data, and lack of morphological descriptors. It is not unlikely that the SCS 232 forms were more precisely geo-referenced and then were abbreviated for the final report. But this can not be confirmed. The descriptions also lack aspect; again, this may have been noted on original SCS 232 forms. It is likely that transect data was present in the 1200 site specific field notes and descriptions that seem to be missing. So overall this probably was a great

Rock Springs Resource Area

Rock Springs was designated as our sample for gathering information for the Kemmerer, Pinedale, and Rock Springs Field offices. The area includes Sublette, Lincoln, Uinta, and western Sweetwater Counties. Most of the area was mapped through BLM contracts. There are also several surveys done by BLM staff and others done by the SCS/NRCS. There are some currently under way NRCS soil surveys in the area, Star Valley, Eden Valley, and Henry's Fork [illegible] the NRCS is [illegible] to complete the Uinta and Sublette County surveys [illegible] Sweetwater and Lincoln [illegible] surveys to be completed. There was not much provided for a lot of the surveys completed in this area. Perhaps some of these surveys would look better if more original data were available.

Sweetwater County

The two largest surveys of this area were done by Soil [illegible]. They are Green River and Salt Wells. Both of these are among the high intensity surveys of Sweetwater County. Green River was published in 1993 and 12 [illegible] sites were mapped in only one field season. Salt Wells [illegible] has been [illegible] in one field season in 1998. It does not specify the [illegible] but appears to be higher. There are no data files and what is included with the [illegible] of the survey. Soil [illegible] was contacted by e-mail, and responded that they [illegible] than five years following [illegible] completion. John [illegible] both surveys [illegible].

[illegible] of Sweetwater [illegible] Rock Springs [illegible] for the [illegible] for the larger [illegible] Rock Springs [illegible] to be [illegible] good survey.

Sublette County

The NRCS is beginning the soil survey of Sublette County this year. Phase 1 of the project will [illegible]. Previous mapping of Sublette County was done by three BLM contracts and [illegible].

The [illegible] survey is located in the [illegible] corner of the county. It was done by ERO Resources Corporation. There is a [illegible] information on the data that was collected for this survey and the [illegible] and the number of description [illegible] from each site. The [illegible] good [illegible] it at some [illegible] to the spatial data [illegible] this survey and the [illegible] survey [illegible] to be pretty good [illegible].

The [illegible] survey [illegible] by ERO Resources Corporation. It was completed in 1988 and is located [illegible] of Big [illegible] out to U.S. HWY 191 to the East. Its [illegible] is [illegible] lack of [illegible], lack of [illegible], and lack of morphological descriptions. It is not unlikely that the SCS 232 forms were more [illegible] and that [illegible] for the final report. But this can not be confirmed. The descriptions also lack [illegible], again, this may have been noted on original SCS 232 forms. It is likely that [illegible] data was present in the 1980 [illegible] field notes and descriptions [illegible] to be missing. So overall this probably was a good survey. The only pedon descriptions are those found in the final report. In the introduction it mentions that there are, or were, over 1200 site specific field notes and soil profile descriptions on file at the BLM Rock Springs. John MacDonald thought it was fairly well done and gave it a B. This survey also received full marks for lab data.

Soapholes is a smaller survey that was first done in the 1960s by the SCS and focused on irrigated lands. This was later added to by John MacDonald. It is not in a published format nor were much data available from the first part from the 1960s

Covering 66,500 acres of Sublette County, the Riley Ridge (Bio-West) field work was completed in 22 days in September of 1981. The surveys states that "Due to the limited amount of information that is available for many of these soils, this correlation should be regarded as being highly tentative." Many of the soils that were mapped are not correlated and are unnamed. I contacted Bio-West personally to see if they had anything more beyond the published survey. They were very helpful but they did not have any data. John MacDonald also found this survey very unreliable.

Big Sandy, an order 4 survey is also in Sublette County but there was not enough to evaluate it. John MacDonald also found it to be useless.

Lincoln County

Outside of Star Valley, Lincoln County has three surveys done on separate allotments. The largest and most complete is the Cumberland allotment. It covers nearly 500,000 acres a small portion of which covers Rich County Utah (32,000 acres) and Uintah County (142,000 acres). It lacks much supporting data, but John MacDonald found it to be satisfactory.

Rock Creek is located just north of Cumberland across US 30. This survey had more original data than most surveys in the area but appeared to be in draft form. Its legend was also hard to follow. It also received a D from John MacDonald. And to the North of Rock Creek is Smiths Fork. There were very little more than aerial photos and the beginnings of map units for this survey. It failed on nearly all accounts.

Uintah County

Currently the NRCS is working to complete the soil survey for this county. Previously the Mountain View Bridger airport survey covered some of the county near Mountain View. John MacDonald recommended that they incorporate it into their survey as he found it to have been done well.

Worland Resource Area

The Big Horn River Basin is potentially the closest to being completely mapped. Washakie county is the only one the four counties in the area that has a completed SCS/NRCS survey. The other three counties: Park (WY 629), Hot Springs, and Big Horn (WY 603), have incomplete or a semi-published survey.

Park and Big Horn were both being worked on during the 1970's but were never brought to completion. A Soil Survey Handbook does exist for each of the two but this is merely an alphabetical collection of map units, soil series descriptions and some detailed legends. The location of the original data is unknown; which will greatly hinder a future effort to bring these surveys to completion. Steve Kiracofe believes the data was last housed with the NRCS. The BLM office in Worland does have aerial photographs with map unit delineations on them. They are securely stored in filing cabinets in the loft above the garage at the BLM Worland field office.

In 1989 and 1990 Glenn William was hired by the BLM to gather more documentation for Park, Big Horn and Hot Springs Counties. His work is a collection of detailed pedon descriptions, observation of the map units and very brief transect descriptions collected from various map units created in from the original surveys.

Despite the questionability of these surveys the field office in Park County has digitized the Mylar overlays from the Park County survey for lack of better product and their need for it. Steve Kiracofe is also working on digitizing Hot Springs County. One of the problems they have encountered is map units that stop at private land holdings. They have also extrapolated other polygon boundaries to the best of their knowledge where none existed. They are including these details in the metadata.

Hot Springs County was mapped in 1978 by SaLUT in survey called Grass Creek. It covers most of the county and much lesser parts of the adjacent counties. The BLM appended around seven more map units, enable completely map the county. Beyond what exists in the semi-published survey I saw no original data, with exception of the aforementioned data gathered by William Glenn. William Glenn gathered much more documentation out of Hot Springs (188 pedon descriptions) County than from Park and Big Horn Counties. Steve Kiracofe also trusts and finds Hot Springs survey to be more useful than the incomplete Park and Big Horn County surveys.

Lander Resource Area

All of the Lander Resource area in Freemont County has been mapped or is in process of being mapped by the NRCS. The only portion of the resource area that has not been mapped is 128,000 acres of northern Sweetwater County. The completed surveys in the area are Lander (1981), Riverton (1974), Dubois and eastern Freemont County (1993). Wind River Basin is currently being worked on.

Greg Bautz found these surveys to be reliable with exception of the Lander soil survey (WY 677). This is because the survey is good over private and irrigated lands; while on BLM lands the map units are vague, too broad and are not specific enough. Some map units he showed us covered large tracts of land with broad slope classes, covering several drainages. Some had Aspen and sagebrush vegetations lumped together into common map units. He mentioned that towards the South Pass there are problems with matching range sites up.

Soil Survey Quality Scores

Introduction

Some surveys have relatively high scores compared to other surveys. This may be due to the availability of documentation or data. It may be fair to say that surveys with more of their original data are more accurately represented. On the other hand a survey may have been mapped with sufficient documentation and therefore be reliable and accurate. Now, however the documentation is not there, and it is not known to what degree of accuracy the survey was completed. It should be noted that this scoring system is not perfect and may be superficial as the only way to know the true accuracy of a survey is through ground-truthing. This scoring system was created to evaluate surveys on merit of data, its utility, and how it is spatially represented. The hope is that if there were data it was accurately gathered. The more data that were gathered, the more accurately soils in the landscape can be interpreted and mapped.

Scoring System

This scoring system divides the soil survey into three categories to be evaluated: I) Data Quality, which consisted of two parts a) attributes and documentation, and B) spatial data, and III) Utility.

I) Data Quality

a. Attributes and Documentation: Attributes and documentation are the "nut and bolts" of a soil survey. Attributes include pedons, map units, and transects. The primary attribute is the pedon, which is a 3-dimensional unit that typifies a unique soil on the landscape. Pedon descriptions include both soil morphological and landscape descriptions. Pedons of similar characteristics can be classified into soil series. Map units are polygons drawn on a map containing a similar distribution of unique soils. Transects are run to characterize the composition and distribution of soils that occur in map units. Transect points can be abbreviated pedon descriptions. Also considered were laboratory data.

   1. Pedon Descriptions x Density
   2. Map Unit Description + (Transects + Density)
   3. Lab Data

b. Spatial Data: To tie the soil survey together, the "nuts and bolts" must be specifically placed; therefore spatial data are required. Pedon descriptions and transects must be geo-referenced to clearly indicate where soils occur on the landscape and to allow for repeated measures. These data are then represented on a map.

   1. Maps

2. Geo-referencing
    a. pedons
    b. transects

II) Utility: Utility includes the age of the soil survey. For example, surveys completed before the seventh approximation and publication of Soil Taxonomy, probably require updating of classification. Format of the survey is also important, e.g., paper maps are easier to use than lines traced on Mylar sheets. In addition, land use interpretations that have been made from the data contribute to utility. Lastly, users of the survey have impressions about its usefulness and assigned the survey a “grade” (i.e., A through F letter grade).

Data quality and utility scores are then combined into an overall quality score. Data quality should be more important than utility because if there are sufficient data that have been gathered accurately from specific, georeferenced points on the landscape (i.e., if data quality is good), the utility of survey can be always improved. However, if data quality is poor, usefulness of maps and interpretation are suspect and the survey may have to be re-done.

Formula and Scoring

Each category has a ratio score with a maximum possible score of 1.0. For example, if the spatial data score is 0.9 then the survey received 90% of the total points possible in the spatial data category. (A score of 0.9 should not be interpreted as an A or 0.5 as failing.)

Formula symbols for each category and sub-categories are represented by an acronym or abbreviation.

I) Data Quality

A. Attribute and Documentation score: AD_s
  1. Pedon description score: Ped_S
  2. Map unit score: MU_S
  3. Lab data: Lab_S

$$0.98\times\left(\frac{(2\times Ped_S)+MU_S}{3}\right)+Lab_S = AD_S$$

B. Spatial Data score: SD_s
  1. Geo-reference points: Geo
  2. Map points: Map

$$\frac{Geo+Map}{10} = SD_S$$

$DATA\ QUALITY\ SCORE = (AD_s + SD_s)/2$

II. Utility score: U_s
  A. Age
  B. Format
  C. Grade
  D. Interpretations:

$(A_s + F_s + G_S + I_S)/14 = U_S$

$$OVERALL\ QUALITY\ SCORE = \frac{(AD_S + SD_S) + U_S}{3} = \frac{(DataQuality \times 2) + U_S}{3}$$

We give the survey two scores to reflect their potential and their current status. The Data Quality score reflects the potential of the survey. As mentioned in the introduction, if data quality is good, there is higher potential for improving the survey such as by developing interpretations, etc. The Overall Quality score reflects the current status of the survey.

I) Data Quality

A. Attributes and Documentation

1. Pedon Descriptions and Density *($PedElems_S$ X $PedDens_S$)*

Pedon Elements: Pedon descriptions should have the 15 following elements: horizon designation, texture, roots, pores, color, slope, aspect, elevation, consistence, pH, reaction, structure, drainage class, landform descriptors, and vegetation.

- Pedon description score will be out of 15 points possible:
  $\#Pedon\ Elements/15 = PedElems_S$

- Excel spread sheets were developed to show scores and identify elements missing from descriptions:

Component name	Elements missing	Pedon points	Pedon score	Acres of component	number of descriptions	score (#description/ req.#)	Overall score	# of descriptions still needed

Elements missing: will list the parts of the pedon description that are missing.
Key to missing elements: (H) - horizon designation, (T) - texture, (R) - roots, (P) - pores, (C) - color, (S) - slope, (A) - aspect, (E) elevation, (Cs) - consistence, (pH) - pH, (Re) - reaction, (St) - structure, (D) - drainage class, (L) landform descriptors, and (V) vegetation

Pedon Density: At the time all these surveys were completed, National Cooperative Soil Survey Standards *(National Soil Survey Handbook,* section *627-08)* were:

- 3 pedons descriptions per map unit components <1000 acres in extent;
- Add 1 pedon description per 3000 acres in for map units components 1000 to 10,000 acres in extent;
- Add 1 pedon description for each additional 10,000 acres of map unit component extent.

Pedons may be from transects, and all components of map units must be adequately described to differentiate it from other components.

The density score will be the number of descriptions divided by the number needed to meet the above standards for each component's area:
0-999 acres = 3; 1,000-3,999 acres = 4; 4,000-6,999 = 5; 7,000-9,999 = 6; 10,000-19,999 = 7; 20,000-29,999 = 8

Pedon Descriptions Observed/Pedon Descriptions Required = $PedDens_S$.

Overall Pedon Score = $Peds_S = PedElems_S \times PedDens_S$

If the $PedElems_S$ score is low, pedons could be described in more detail. If the $PedDens_S$ score is low, more pedons could be described. A low $Peds_S$ scores indicates that the raw data documenting map unit components can be improved.

2. Map Unit Descriptions and Transects

Map units and their distribution of components are determined by: 1) descriptions of the range in landscape features (slope, climate, vegetation, & landform) and the number and type of soil components present in the map unit; and 2) transects.

Map Unit Descriptions: Map unit descriptions needed the following seven descriptors to receive full marks: climate, range type (vegetation, etc.), landform, slope, elevation range, abbreviation of soil characteristics and soil component break down (e.g., 50% of soil A, 30% of soil B, 20% other). Each will be weighted equally for a total of seven points.

- The map unit description score is the actual points received divided by the total potential of 7 points: *Map Unit Descriptors Present/7* = $MUDs_S$

Transects:

Elements: There should be 14 elements in the pedon point data in transects: horizon designation, texture, color, slope, aspect, elevation, consistence, pH, reaction, drainage class, landform descriptors, vegetation, boring interval, transect direction.

- Transect element score is the number of elements present in the transect data divided by 14 possible elements: *Transect Elements Present/14* = $TranElems_S$

Number: The number of transect points (observations) needed is dependent on the area of the map unit. At the time all these surveys were completed, National Cooperative Soil Survey Standards *(National Soil Survey Handbook,* section *627-08)* were:

- 3 10-observation transects (30 points) per map units <1000 acres in extent;
- Add 1 10-observation transect per 3000 acres in for map units 1000 to 10,000 acres in extent;
- Add 1 10-observation transect for each additional 10,000 acres of map unit extent.

The required number of transect points needed for a given area of map unit:
0-999 acres: 30 points, 1,000-3,999 acres 40 points, 4,000-6,999 acres: 50 points, 7,000-9,999 acres: 60 points, 10,000-19,999 acres: 70 points, 20,000-29,999 acres: 80 points.

- Transect number score is the number of transect points present in the transect data divided by total possible points for the given area:

Transect data points present/total required points $= TranPoints_S$

Overall Transect Score$= Trans_S = TranElems_S + TranPoints_S$

$$\textit{Overall Map Unit Score} = \frac{MUD_S + Tran_S}{2} = MU_S$$

Unfortunately, transect data is almost never included in the final soil survey product. Even with soil surveys performed by NRCS, transect data is only rarely entered into NASIS -- when a transect point is going to be used as a pedon description to correlate a component. As a result, transect data was often not easily found in these surveys. If no transect data were found, the possible maximum score for Map Units was 0.5 or 50%.

3. Lab Data

To meet National Cooperative Soil Survey Standards, laboratory characterization data of typical pedons are normally required. Because most soil surveys – even those conducted by NRCS – do not fully report lab data, we assigned the Lab Data Score (Lab_S) to be worth 2% (0.02) of the total Attribute and Documentation score. The Lab Data Score was 0 if it appeared that no lab data were obtained. If most typical pedons had lab data, Lab_S was 0.02.

Attribute & Documentation Total Score

The three areas that make up the score for Attributes and Documentation are A) Pedon Descriptions, B) Map Units, and C) Lab Data. Not all of them hold equal weight.

Overall Attribute and Documentation Score =

$$0.98 \times \left(\frac{(2 \times Ped_S) + MU_S}{3} \right) + Lab_S = AD_S$$

B. Spatial Data

The landscape can be represented visually on map and by individual points (which must be geo-referenced using some kind of coordinate system). Map units are polygons topologically represented on maps and pedons geo-referenced points. It is essential that both be mapped and geo-referenced accurately.

Geo-referencing of a pedon is as important as knowing what the characteristics of pedon are. Coordinate systems that can be used are stateplane, latitude and longitude, or UTM. Relative locations are only useful to a user insofar as the reference point is known to them; relative locators may disappear (building or ranch) and may be difficult to locate on a map.

Not having a map with map unit polygons on it makes the survey nothing more than a stack of data.

1. Maps

The formats of soil maps have been lumped into five general categories, which have been ranked with a possible score based on there utility to the user.

- Digitized format (5 points possible) soil maps that have been digitized and accessible through a GIS. Digitized formats may be checked by comparing map unit attribute, such as slope, against a slope DEM. (must have an attribute table).
- Paper map (4 points possible) usually 7.5 minute quads, either orthophoto quad or contour. (Must have a current legend of map units).
- Aerial photos (2 points possible). (A working legend must accompany them).
- General maps (1 point possible), soil maps that are a smaller scale and/or have broader less detailed soil classifications. (Must have a legend).

2. Geo-referenced

Each pedon must be geo-referenced so its location in the landscape is known. Again, as with the map formats, a maximum of five points is possible. Below in order from 1 to 5 five points, are the ranges of accuracy for each coordinate system or unit of measure:

UTM	Feet (stateplane)	Latitude, Longitude	Stateplane	Area (acres)
± 800 m	± 2600 ft	± 30", ± 30"	section	640 (1 mile^2)
± 400 m	± 1300 ft	± 15", ± 15"	section,¼	160
± 200 m	± 750 ft	± 7", ± 8"	section, ¼, ¼	40
± 100 m	± 300 ft	± 3", ± 4"	sect., ¼, ¼, ¼	10
± 50 m	± 150 ft	± 1.5", ± 2"	NA	2.5 (1 hectare)

3. Spatial Data Total Score

Geo-referencing and maps will hold equal weight. Both were out of 5 points so the overall score will be out of 10 points.

$$\frac{Geo + Map}{10} = SD_S$$

II) Utility

Each of the three sections of this category has 4 points possible. These sections represent what has been done with the data and its current state.

1. Age

The Age: the era in which the survey was completed should reflect which version of "Soil Taxonomy" that was used. 1983, the first of edition of *Key to Soil Taxonomy* came out. Surveys before 1975 were done before the release of *Soil Taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys.*

All surveys receive at least one point and more recent surveys receive two points, using the assumption that *Keys to Soil Taxonomy* was used: Pre-1975 "1"; 1975-present "2". The age of a survey is part of the qualitative score. I felt that it would fit best in this category as classifications from older versions could be translated into newer versions of taxonomy and classifications are products of your data (the observations from the landscape and pedons).

2. Format

This refers to the completeness and order of a survey. Some are just a stack of papers in a filing cabinet while others are bound and contain a map along side it.
"0" very little or nothing exists, "1" stack of paper, usually a survey that is incomplete, "2" an ordered draft, ordered section of survey exist; "3" bound, a final draft; "4" final draft with soils map, example is published NRCS surveys which have map and the end or in the folder with survey.

3. Grade

This section will be an assigned letter grade given by the area representative. A: 4, B: 3, C: 2, D: 1, F: 0. This grade will be based on how the survey fills the need of the land manager: "A" is excellent, it is very useful and reliable, little field checking required. "B" is useful and still can be trusted but more field checking required but still manageable. "C" useful for only broad bush planning, too much field checking required. "D" too vague for most land management purposes. "F" useless.

Time Frame

Some soil surveys were done in a time frame that does not seem realistic for their size. An example is one of 3 million acres mapped in just two field seasons. It does not seem likely that this large of an area could be mapped accurately in so short a time frame, even if multiple teams were doing the mapping. Proper correlation and field checks of such an effort would be near impossible in so short a time. As this is more of subjective observation it is hard to score. Such details as to how many they had working with them, and what is a realistic standard for acres mapped per soil scientist should be considered. Instead of being part of the score, if a survey was done in an unrealistic time frame it will be noted in the summary. It is likely that these same surveys lack enough transects and pedon descriptions too. So the time frame may also be reflected indirectly in the overall score.

Recommendations

Rawlins Resource Area

The soil surveys of the Rawlins Resource Area are not all together useless. As original documentation exists for many of the surveys a future survey team need not start from scratch. Difficulties with this would be collaboration (following in their footsteps) with the work of these past survey teams some twenty to thirty years later. The Shirley Basin, Overland TRC and Overland SaLUT, are the largest contributors of data. Lesser amounts of data are available from the Elk Mountain, Encampment, and Sage Creek surveys. Seven Lakes would contribute nothing of value to this effort. It would also make sense, as far as the BLM and NRCS are concerned to complete the Sweetwater County as East and West Sweetwater County surveys instead of North and South. The Rock Springs Field Office would give more access to western Sweetwater and Rawlins gives more access to eastern Sweetwater. Also, both of their respective resource areas divide the county into two halves.

Tighten:

The collection of additional pedon descriptions through field checks of existing map units will allow a future survey team to understand and to determine accuracy of the methodologies from previous survey teams. In this process additionally needed pedon descriptions that are needed to meet the MOU (memorandum of understanding) could be gathered, errors in previous mapping can be found and corrected and existing surveys may be updated.

Legend:

As current map units are field checked and corrected, the addition of new map units may be needed. It is likely that there are new soil series that better fit the classification of some soils. This would require an overhauling of the current working legend. Due to the fact that four different survey teams mapped the majority of the existing surveys in the Rawlins area, there are likely some redundancies in map units. Some map units may be lumped together or redefined to incorporate the range of characteristics throughout the resource area. Also, Sage Creek would have to be updated to fit current map legend as its legend is not in common with the rest of the resource area (having been completed before creation of current legend). Sage Creek was also completed before Soil Taxonomy in 1975, so existing soils may need to be reclassified to increase its utility in making interpretations and to be incorporated with current legend. The map units covering Shirley Basin also appear to be in draft format, meaning they appear to have never been finalized.

Refine:

No survey is likely to be perfect. The range of soil characteristics for each map unit is usually given; nevertheless that soil may lie outside that range or may be an unmentioned inclusion. Using GIS/Remote Sensing Technologies some of these characteristics can be checked or verified. Digitized map units may be classified based on an attribute such as slope. Slope is an important characteristic in soil formation and land management planning. It is also relatively easy to check using slope DEMs of the survey area. Doing this one can compare a map units

slope range against the actual underlying slope. (We did this as a test in Carbon County…).

Through this process and others map units can be remotely verified and refined. Also portions of map units that have been field checked and verified to accurately represent characteristics of a map unit, can in turn be used as a knowledge base for further classification in the area.

Worland Resource Area

Using similar procedures as described for the Rawlins Resource Area, the Big Horn River Basin could be brought to completion. The counties lacking completed surveys are Park and Big Horn Counties (incomplete SCS surveys) and Hot Springs County (semi published survey done by SaLUT, Grass Creek). All three counties had data amended to them by William Glenn. Hot Springs had the most added to it by William Glenn and has formalized map units and legend to start a future survey from. For Park and Big Horn Counties, it appears that the map units were still being refined and formalized for these surveys; but now there is no data beyond some drafts of map unit descriptions and soil series descriptions. Without the original data, these counties have little more than the amendments made by William Glenn.

The Big Horn and Park Counties appear to have a similar legends but with some differences. The Grass Creek survey has a different legend that is not in common with the others. A future survey team may want to use the Washakie County survey legend as compendium or a template to complete these surveys, adding needed map units.

Rock Springs Resource Area

Many of the surveys in the Rock Springs Resource Area do not have very much supporting data, which will hinder future use of them. Big Piney/LeBarge, Salt Wells, Green River, Bio-West and Burma Road are all surveys in semi published format. None of them have external supporting data outside of the final report. Soapholes, Tri-Territories, Rock Creek, Cumberland, and Mountain View all have some supporting data in varied amounts. But, most of them are cover smaller areas than the aforementioned surveys. With a NRCS soil survey underway in Uinta County and another beginning in Sublette County, Lincoln and Sweetwater Counties will remain to be mapped.

Lincoln Counties surveys: Cumberland, Rock Creek and Smith's Fork. Cumberland is the largest of the three surveys but lacks supporting data while Rock Creek's supporting data is poorly geo-referenced making it difficult to use in a future survey. Smith's Fork is probably useless, being little more than some map units drawn over some aerial photos.

As the survey progresses in Sublette County, the Burma Road and Big Piney/LeBarge surveys may be useful for pre-mapping and a foundation for some map units. More field work is required to gather additional documentation in these survey areas though. Bio-West is a smaller survey; it was also done rather hastily, so quality control may be an issue there. The Soapholes survey has supporting data but is also a much smaller survey.

Western Sweetwater County's two major surveys are Green River and Salt Wells. Both were done by SaLUT and cover large areas mapped in a very short relative amount of time. They also all lack supporting data limiting their future use in a comprehensive

survey. The Tri-Territories is a smaller survey. As an order 2 survey it has insufficient data but has some nonetheless.

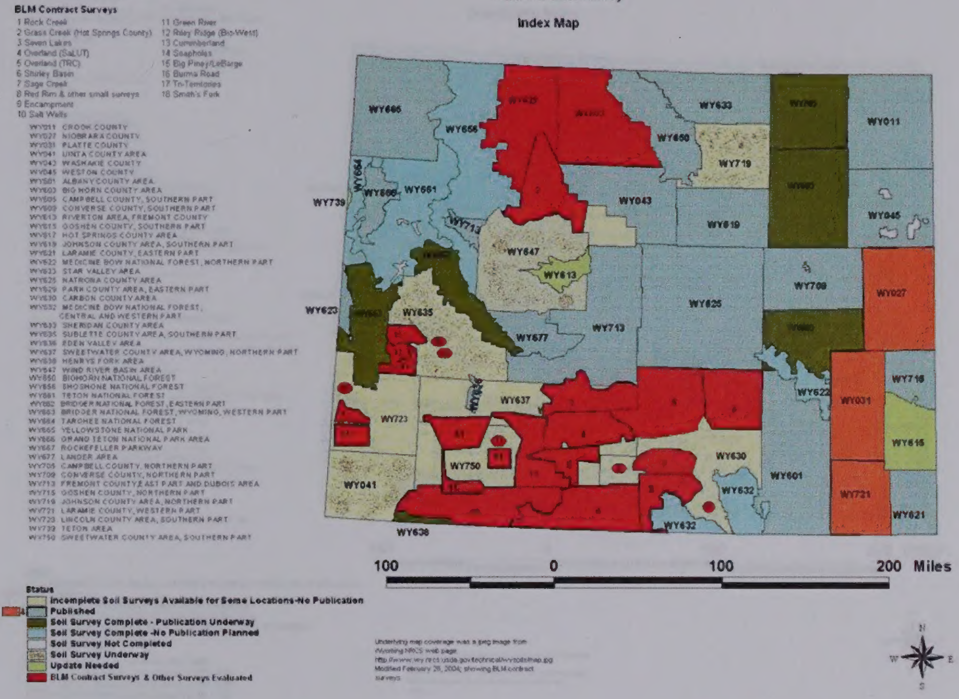
Gneral Purc approach

Table 1. Summary of soil survey scores and rankings in the Rock Springs, Rawlins, and Worland Resource Areas.

Survey	Map Index Number	Attribute/Doc	Spatial	Data Quality	Utility	Overall Quality	Overall Rank	Class†
Rock Springs								
Soapholes	14	0.28	0.60	0.44	0.64	0.507	8	2
Burma Road	16	0.41	0.40	0.41	0.79	0.533	4	2
Cumberland	13	0.19	0.48	0.33	0.66	0.445	13	3
Smiths Fork	18	0.07	0.20	0.14	0.21	0.161	19	4
Rock Creek	1	0.35	0.40	0.37	0.36	0.369	17	3
Big Piney/LeBarge	15	0.29	0.50	0.40	0.86	0.549	3	2
Salt Wells (SaLUT)	10	0.18	0.60	0.39	0.68	0.487	10	2
BioWest-Riley Ridge	12	0.21	0.67	0.44	0.68	0.521	6	2
Tri-Territories	17	0.18	0.50	0.34	0.57	0.418	14	3
Green River (SaLUT)	11	0.18	0.60	0.39	0.68	0.485	11	2
Rawlins								
Shirley Basin	6	0.23	0.66	0.45	0.32	0.405	15	3
Seven Lakes	3	0.14	0.10	0.12	0.25	0.163	18	4
Overland (SaLUT)	4	0.34	0.65	0.50	0.82	0.604	2	1
Sage Creek	7	0.25	0.60	0.42	0.69	0.514	7	2
Encampment	9	0.46	0.43	0.45	0.21	0.370	16	3
Overland (TRC)	5	0.40	0.61	0.50	0.57	0.526	5	2
Worland								
Hot Springs County	2	0.45	0.65	0.55	0.80	0.634	1	1
Park County	WY629	0.38	0.63	0.50	0.48	0.494	9	2
Big Horn County	WY603	0.27	0.60	0.43	0.48	0.450	12	3

†Class 1 = ≥0.60; Class 2 = 0.45-0.60; Class 3 = 0.30-0.45; Class 4 = <0.30

Figure 1 Index Map of all surveys scored


BLM Contract Survey
Index Map
BLM Contract Surveys
1 Rock Creek
2 Grass Creek (Hot Springs County)
3 Seven Lakes
4 Overland (SaLUT)
5 Overland (TRC)
6 Shirley Basin
7 Sage Creek
8 Red Rim & other small surveys
9 Encampment
10 Salt Wells
11 Green River
12 Riley Ridge (Bio-West)
13 Cumberland
14 Soapholes
15 Big Piney/LaBarge
16 Burma Road
17 Tri-Territories
18 Smith's Fork
WY011 CROOK COUNTY
WY027 NIOBRARA COUNTY
WY031 PLATTE COUNTY
WY041 UINTA COUNTY AREA
WY043 WASHAKIE COUNTY
WY045 WESTON COUNTY
WY601 ALBANY COUNTY AREA
WY603 BIG HORN COUNTY AREA
WY605 CAMPBELL COUNTY, SOUTHERN PART
WY609 CONVERSE COUNTY, SOUTHERN PART
WY613 RIVERTON AREA, FREMONT COUNTY
WY615 GOSHEN COUNTY, SOUTHERN PART
WY617 HOT SPRINGS COUNTY AREA
WY619 JOHNSON COUNTY AREA, SOUTHERN PART
WY621 LARAMIE COUNTY, EASTERN PART
WY622 MEDICINE BOW NATIONAL FOREST, NORTHERN PART
WY623 STAR VALLEY AREA
WY625 NATRONA COUNTY AREA
WY629 PARK COUNTY AREA, EASTERN PART
WY630 CARBON COUNTY AREA
WY632 MEDICINE BOW NATIONAL FOREST, CENTRAL AND WESTERN PART
WY633 SHERIDAN COUNTY AREA
WY635 SUBLETTE COUNTY AREA, SOUTHERN PART
WY636 EDEN VALLEY AREA
WY637 SWEETWATER COUNTY AREA, WYOMING, NORTHERN PART
WY638 HENRYS FORK AREA
WY647 WIND RIVER BASIN AREA
WY650 BIGHORN NATIONAL FOREST
WY656 SHOSHONE NATIONAL FOREST
WY661 TETON NATIONAL FOREST
WY662 BRIDGER NATIONAL FOREST, EASTERN PART
WY663 BRIDGER NATIONAL FOREST, WYOMING, WESTERN PART
WY664 TARGHEE NATIONAL FOREST
WY665 YELLOWSTONE NATIONAL PARK
WY666 GRAND TETON NATIONAL PARK AREA
WY667 ROCKEFELLER PARKWAY
WY677 LANDER AREA
WY705 CAMPBELL COUNTY, NORTHERN PART
WY709 CONVERSE COUNTY, NORTHERN PART
WY713 FREMONT COUNTY EAST PART AND DUBOIS AREA
WY715 GOSHEN COUNTY, NORTHERN PART
WY719 JOHNSON COUNTY AREA, NORTHERN PART
WY721 LARAMIE COUNTY, WESTERN PART
WY723 LINCOLN COUNTY AREA, SOUTHERN PART
WY739 TETON AREA
WY750 SWEETWATER COUNTY AREA, SOUTHERN PART
Status
Incomplete Soil Surveys Available for Some Locations-No Publication
Published
Soil Survey Complete - Publication Underway
Soil Survey Complete -No Publication Planned
Soil Survey Not Completed
Soil Survey Underway
Update Needed
BLM Contract Surveys & Other Surveys Evaluated
WY665
WY656
WY633
WY011
WY650
WY719
WY664
WY666
WY661
WY739
WY043
WY619
WY045
WY647
WY613
WY623
WY635
WY625
WY709
WY027
WY677
WY713
WY622
WY031
WY715
WY637
WY723
WY630
WY750
WY041
WY601
WY632
WY721
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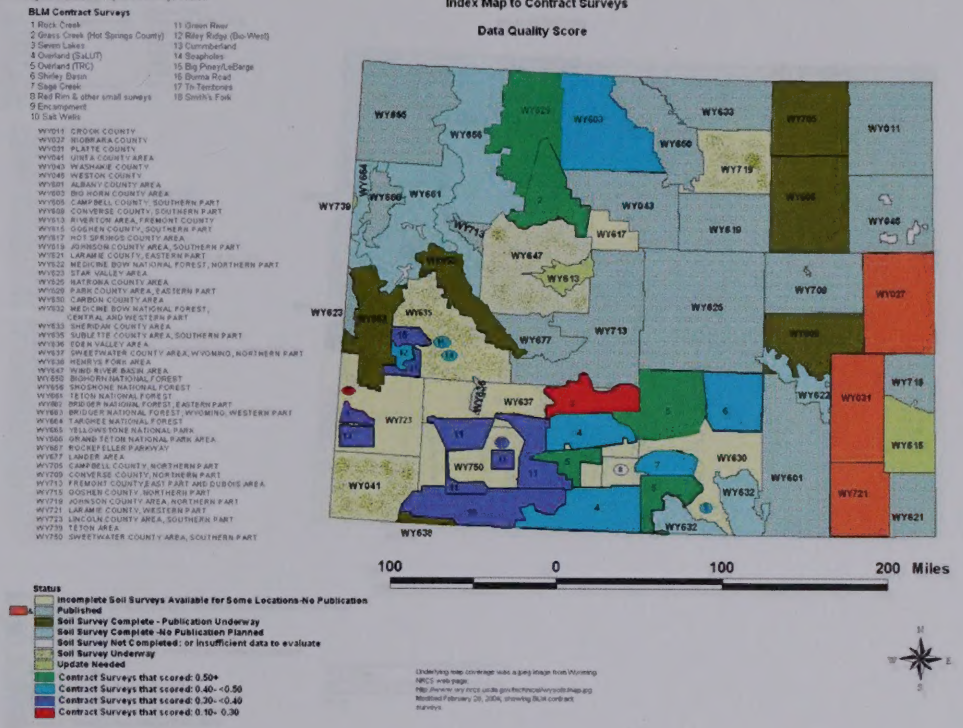
Underlying map coverage was a jpeg image from Wyoming NRCS web page http://www.wy.nrcs.usda.gov/technical/wysoilsmap.jpg Modified February 28, 2004; showing BLM contract surveys

Figure 2 Data Quality for all surveys scored



Index Map to Contract Surveys

Data Quality Score

BLM Contract Surveys
1 Rock Creek
2 Grass Creek (Hot Springs County)
3 Seven Lakes
4 Overland (SaLUT)
5 Overland (TRC)
6 Shirley Basin
7 Sage Creek
8 Red Rim & other small surveys
9 Encampment
10 Salt Wells
11 Green River
12 Riley Ridge (Bio-West)
13 Cummberland
14 Soapholes
15 Big Piney/LeBarge
16 Burma Road
17 Tri-Territories
18 Smith's Fork
WY011 CROOK COUNTY
WY027 NIOBRARA COUNTY
WY031 PLATTE COUNTY
WY041 UINTA COUNTY AREA
WY043 WASHAKIE COUNTY
WY045 WESTON COUNTY
WY601 ALBANY COUNTY AREA
WY603 BIG HORN COUNTY AREA
WY605 CAMPBELL COUNTY, SOUTHERN PART
WY608 CONVERSE COUNTY, SOUTHERN PART
WY613 RIVERTON AREA, FREMONT COUNTY
WY615 GOSHEN COUNTY, SOUTHERN PART
WY617 HOT SPRINGS COUNTY AREA
WY619 JOHNSON COUNTY AREA, SOUTHERN PART
WY621 LARAMIE COUNTY, EASTERN PART
WY622 MEDICINE BOW NATIONAL FOREST, NORTHERN PART
WY623 STAR VALLEY AREA
WY625 NATRONA COUNTY AREA
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WY630 CARBON COUNTY AREA
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WY633 SHERIDAN COUNTY AREA
WY635 SUBLETTE COUNTY AREA, SOUTHERN PART
WY636 EDEN VALLEY AREA
WY637 SWEETWATER COUNTY AREA, WYOMING, NORTHERN PART
WY638 HENRYS FORK AREA
WY647 WIND RIVER BASIN AREA
WY650 BIGHORN NATIONAL FOREST
WY656 SHOSHONE NATIONAL FOREST
WY661 TETON NATIONAL FOREST
WY662 BRIDGER NATIONAL FOREST, EASTERN PART
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WY664 TARGHEE NATIONAL FOREST
WY665 YELLOWSTONE NATIONAL PARK
WY666 GRAND TETON NATIONAL PARK AREA
WY667 ROCKEFELLER PARKWAY
WY677 LANDER AREA
WY705 CAMPBELL COUNTY, NORTHERN PART
WY709 CONVERSE COUNTY, NORTHERN PART
WY713 FREMONT COUNTY EAST PART AND DUBOIS AREA
WY715 GOSHEN COUNTY, NORTHERN PART
WY719 JOHNSON COUNTY AREA, NORTHERN PART
WY721 LARAMIE COUNTY, WESTERN PART
WY723 LINCOLN COUNTY AREA, SOUTHERN PART
WY739 TETON AREA
WY750 SWEETWATER COUNTY AREA, SOUTHERN PART
Status
Incomplete Soil Surveys Available for Some Locations-No Publication
Published
Soil Survey Complete - Publication Underway
Soil Survey Complete -No Publication Planned
Soil Survey Not Completed: or insufficient data to evaluate
Soil Survey Underway
Update Needed
Contract Surveys that scored: 0.50+
Contract Surveys that scored: 0.40- <0.50
Contract Surveys that scored: 0.30- <0.40
Contract Surveys that scored: 0.10- 0.30
WY656
WY666
WY629
WY603
WY633
WY705
WY011
WY650
WY715
WY664
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WY739
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WY041
WY601
WY632
WY721
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WY638
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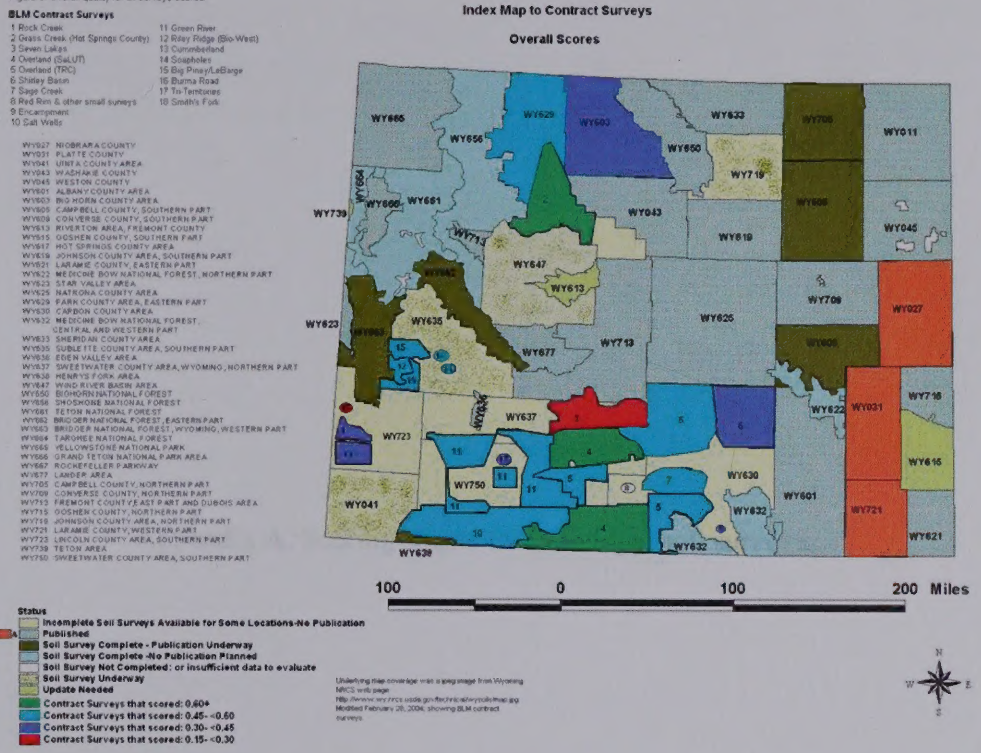
Underlying map coverage was a jpeg image from Wyoming NRCS web page. http://www.wy.nrcs.usda.gov/technical/wysoils/map.jpg Modified February 20, 2004, showing BLM contract surveys.

Figure 3. Overall quality for all surveys scored


BLM Contract Surveys
1 Rock Creek
2 Grass Creek (Hot Springs County)
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WY027 NIOBRARA COUNTY
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WY723 LINCOLN COUNTY AREA, SOUTHERN PART
WY739 TETON AREA
WY750 SWEETWATER COUNTY AREA, SOUTHERN PART
Index Map to Contract Surveys
Overall Scores
WY665
WY656
WY629
WY603
WY633
WY705
WY011
WY650
WY719
WY664
WY666
WY661
WY739
WY043
WY605
WY045
WY619
WY713
WY647
WY613
WY662
WY709
WY027
WY623
WY663
WY635
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WY677
WY713
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WY622
WY031
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WY723
WY636
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WY630
WY615
WY041
WY632
WY601
WY721
WY621
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12
13
14
15
16
17
18
100
0
100
200 Miles
Status
Incomplete Soil Surveys Available for Some Locations-No Publication
Published
Soil Survey Complete - Publication Underway
Soil Survey Complete -No Publication Planned
Soil Survey Not Completed: or insufficient data to evaluate
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Update Needed
Contract Surveys that scored: 0.60+
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Contract Surveys that scored: 0.30- <0.45
Contract Surveys that scored: 0.15- <0.30
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Underlying map coverage was a jpeg image from Wyoming NRCS web page http://www.wy.nrcs.usda.gov/technical/wysoils/map.jpg Modified February 28, 2004, showing BLM contract surveys.

Appendix A. Scoring sheets for individual soil surveys.

Soapholes/Big Sandy

Attrib/Doc	0.28			Spatial	0.60		Utility	0.64		
Pedon Score	0.25	Map Unit	0.29	Maps	Geo-Ref	3.00	Age	Format	Grade	Interpretations
Description	Density	Description	Transect	3.00	pedons	transects	2.00	2.00	4.00	1
0.60	0.42	0.57	0.00		3.00	0.00				

map units	pedon points	# of pedons	# of comp.	# descr. Required	# still needed
2		0	1	3	3
11		0	1	3	3
31		13	1	3	0
31D		4	1	3	0
59		6	1	3	0
64		0	1	3	3
66		0	1	3	3
68		0	1	3	3
77		1	1	3	2
85		3	1	3	0
227		3	1	3	0
231		0	2	6	6
235		0	2	6	6
264		0	3	9	9
266		0	2	6	6
304		12	2	6	0
307		3	2	6	3
319		5	3	9	4
364		0	1	3	3
366		0	2	6	6
511		11	1	3	0
575		1	1	3	2
591		8	1	3	0
631		2	1	3	1
2118		7	1	3	0
2120		2	1	3	1
2120D		0	1	3	3
2140		1	1	3	2
2215		11	1	3	0
2833		4	2	6	2
		97		123	71
				0.42	

Lab Data
0.02

Cumberland

Attrib/Doc 0.19				Spatial 0.48			Utility 0.66			
Pedon Score 0.08		Map Unit 0.43		Maps	Geo_ref 1.80		Age	Format	Grade	Interpretations
Description	Density	Description	Transect	3.00	pedons	transects	2.00	2.30	2.00	3
0.93	0.08	0.86	0.00		1.80	0.00				

Lab Data
0

133 map units
49 known pedon descriptions
So at least 400 pedon descriptions are needed if not more (perhaps nearly double this)

Smiths Fork

Attrib/Doc 0.07				Spatial 0.20			Utility 0.21			
Pedon Score 0.00		Map Unit 0.21		Maps	Geo-Ref 0.00		Age	Format	Grade	Interpretations
Description	Density	Description	Transect	2.00	pedons	transects	2.00	1.00	0.00	0
0.00	0.00	0.43	0.00		0.00	0.00				

Lab
Data
0

16 map units
no pedon descriptions or transect data
soils are classified to family level but are not correlated to soil series

Rock Creek

Attrib/Doc 0.35				Spatial 0.40			Utility 0.36			
Pedon Score 0.29		Map Unit 0.49		Maps	Geo-Ref 1.00		Age	Format	Grade	Interpretations
Description	Density	Description	Transect	3.00	pedons	transects	2.00	1.50	1.00	0.5
0.67	0.43	0.69	0.30		1.00	1.00				

There appears to be 400 transect points
57 Pedon Descriptions
At least 44 mapping units

Lab Data
0

Tri-Territories

Attrib/Doc 0.18				Spatial 0.50			Utility 0.57			
Pedon Score 0.06		Map Unit 0.44		Maps	Geo-Ref 2.00		Age	Format	Grade	Interpretations
Description	Density	Description	Transect	3.00	pedons	transects	2.00	1.00	3.00	2
0.60	0.10	0.57	0.30		4.00	0.00				

74 map units
about 40 transect receiving points 6/14 for description. It would need at least 3*74=222
23 pedon descriptions

Lab Data
0

Seven Lakes

Attrib/Doc 0.14				Spatial 0.10			Utility 0.25			
Pedon Score 0.00		Map Unit 0.43		Maps	Geo-Ref 0.00		Age	Format	Grade	Interpretations
Description	Density	Description	Transect	1.00	pedons	transects	0.00	2.00	0.50	1
0.00	0.00	0.86	0.00		0.00	0.00				

Lab Data
0

Burma Road by ERO Resources Corporation
Feb-88

Attrib/Doc	0.41			Spatial	0.40		Utility	0.79		
Pedon Score	0.38	Map Unit	0.43	Maps	Geo-Ref	1.00	Age	Format	Grade	Interpretations
Description	Density	Description	Transect	3.00	pedons	transects	2.00	3.00	3.00	3
0.80	0.48	0.86	0.00		1.00	0.00				

map units	# pedon descriptions	% of 1st component	% of 2nd component	% of 3rd component	acreage	# required
100		0.35	0.3	0.25		3
101		0.3	0.3	0.25		3
102		0.65	0.25	0		2
103		0.35	0.3	0.15		3
104		0.95	0	0		1
105		0.9	0	0		1
106		0.6	0.3	0		2
107		0.95	0	0		1
108		0.4	0.3	0.2		3
109		0.9	0	0		1
110		0.65	0.25	0		2
111		0.45	0.25	0.2		3
112		0.9	0	0		1
113		0.45	0	0		1
114		0.4	0	0		1
115		0.85	0	0		1
116		0.4	0.35	0.15		3
117		0.45	0.2	0		2
118		0.3	0.3	0		2
119		0.45	0.4	0		2
120		0.45	0.25	0.2		3
121		0.4	0.25	0.2		3
122		0.35	0.25	0.2		3
123		0.35	0.35	0.15		3
124		0.3	0.3	0.25		3
125		0.5	0.4	0		2
126		0.5	0.45	0		2
127		0.35	0.35	0.2		3
128		0.5	0.2	0.2		3
129		0.4	0.25	0.2		3
BL		1	0	0		1
total	32					67

Only 32 descriptions as present in final report.

The only pedon descriptions are those found in the final report. In the introduction it mentions that there are or were over 1200 site specific field notes and soil profile descriptions on file at the BLM Rock Springs.

This surveys score is low due to its lack of geo-referencing, no transect data, and morphological descriptor not described. It is not unlikely that the SCS 232 forms were more precisley geo-referenced but abbreviated for the final report. But this can not be confirmed. The descriptions also lack aspect, again, this may have been note on original SCS 232 forms. It is likely that transect data was present in the 1200 site specific field notes and descriptions that seem to be missing. So overall this probably was a great survey. John MacDonald thought it was failry well done and gave it a B.This survey also received full marks for lab data.

Encampment

Attrib/Doc	0.46			Spatial	0.43		Utility	0.21		
Pedon Score	0.56	Map Unit	0.31	Maps	Geo-Ref	2.33	Age	Format	Grade	Interpretations
Description	Density	Description	Transect	2.00	pedons	transects	2.00	1.00	0.00	0.00
1.00	0.56	0.14	0.47		3.00	1.00				

Map Units	pedon points	# of descr	transect		# of compon.	pedons requ.	Lab Data
11	15	3			3	9	0
12	15	3			2	6	
31	15	1	12	12	3	9	
32	15	11			2	6	
33	15	4			2	6	
34	15	5			2	6	
61	15	2			2	6	
62	15	3			3	9	
63	15	2			2	6	
71	15	3			2	6	
72	15	8			3	9	
73	15	1			2	6	
91	15	1			1	3	
92	15	3			2	6	
93	15	5			2	6	
total/average	15	55	12	12		99	

450 transect points needed

transect score
0.47

Resource Area	Survey Name	Acreage	Done by:
Rawlins	Red Rim	12,800	SCS
	China Butte Lease	16,800	Mine Reclamation Consultants Inc.
	Atlantic Rim	?	Mine Reclamation Consultants Inc.
	Crestone-Cherokee Lease	13,760	Mine Reclamation Consultants Inc.
Rock Springs	Big Sandy	?	BLM?

Big Piney/LeBarge

Attrib/Doc	0.29			Spatial	0.50		Utility	0.86		
Pedon Score	0.20	Map Unit	0.43	Maps	Geo-Ref	2.00	Age	Format	Grade	Interpretations
Description	Density	Description	Transect	3.00	pedons	transects	2.00	3.00	3.00	4
0.67	0.30	0.86	0.00		2.00	0.00				

map unit	# of descrip	# of compon.	# descr req.	Lab Data
100	4	3	9	0.02
101	3	3	9	
102	1	2	6	
103	1	2	6	
104	3	2	6	
106	2	2	6	
107	2	2	6	
109	1	1	3	
110	1	2	6	
112	4	3	9	
124	0	2	6	
150	4	3	9	
151	1	3	9	
152	1	3	9	
153	3	2	6	
154	4	3	9	
156	1	1	3	
157	2	2	6	
164	1	2	6	
165	2	2	6	
204	3	2	6	
205	3	3	9	
206	0	1	3	
207	2	2	6	
208	4	3	9	
209	7	3	9	
210	4	2	6	
211	3	3	9	
212	0	3	9	
213	1	3	9	
214	0	3	9	
215	2	3	9	
216	2	2	6	
218	0	2	6	
219	1	2	6	
220	2	2	6	
221	1	3	9	
300	3	2	6	
301	2	2	6	
302	0	3	9	
304	3	2	6	

305	3	3	9
306	0	3	9
307	0	2	6
308	0	1	3
311	3	2	6
312	1	2	6
313	3	2	6
314	3	3	9
317	1	2	6
318	3	3	9
319	4	3	9
320	1	1	3
321	4	3	9
322	2	2	6
326	0	1	3
355	0	3	9
400	4	3	9
401	0	1	3
402	0	1	3
403	4	3	9
405	1	3	9
406	5	3	9
410	3	3	9
411	2	2	6
412	2	2	6
413	1	1	3
414	2	1	3
415	4	2	6
416	3	2	6
417	1	1	3
418	2	2	6
420	2	2	6
	148		492

Salt Wells

Attrib/Doc	0.18			Spatial	0.60		Utility	0.68		
Pedon Score	0.09	Map Unit	0.36	Maps	Geo-Ref	3.00	Age	Format	Grade	Interpretations
Description	Density	Description	Transect	3.00	pedons	transects	2.00	3.00	1.00	3.5
0.59	0.16	0.73	0.00		3.00	0.00				

map units	# of descrip.	1st comp	2nd comp	3rd comp.	# req	# of comp.	Lab Data
301		1				1	0.005
402		0.6	0.3			2	
404		0.6	0.4			2	
413		0.6	0.3			2	
414		1				1	
421		1				1	
423		1				1	
429		1				1	
430		0.5	0.3			2	
436		0.6	0.2			2	
438		0.6	0.2			2	
439		1				1	
440		0.3	0.3	0.2		3	
441		1				1	
444		1				1	
445		1				1	
446		0.3	0.2	0.2		3	
447		1				1	
449		0.6	0.3			2	
451		0.4	0.4			2	
452		0.5	0.25			2	
453		0.4	0.25			2	
455		1				1	
458		0.4	0.3			2	
459		0.25	0.25			2	
460		1				1	
461		0				1	
462		0.6				1	
463		0.4	0.4			2	
464		0.4	0.4			2	
466		0.4	0.2			2	
467		0.4	0.2			2	
468		0.4	0.2	0.2		3	
473		0.6	0.3			2	
475		0.5	0.35			2	
476		0.25	0.25	0.2		3	
479		1				1	
480		1				1	
482		0.6	0.3			2	
487		0.6				1	
488		1				1	

501	1			1
502	1			1
504	0.55	0.35		2
505	0.25	0.25	0.25	3
506	0.3	0.3		2
507	0.6	0.3		2
508	1			1
509	0.4	0.2		2
513	0.45			1
514	0.5	0.3		2
515	0.55	0.3		2
520	0.4	0.2	0.2	3
522	0.4	0.2	0.15	3
523	0.6	0.25		2
524	0.5	0.3		2
525	1			1
526	0.25	0.2		2
527	0.5	0.3		2
530	0.5	0.3		2
543	1			1
544	1			1
546	1			1
551	0.45	0.35		2
553	0.5	0.4		2
555	1			1
563	0.3	0.3	0.2	3
575	0.5	0.25		2
576	0.3	0.3	0.2	3
579	0.6	0.2		2
590	0.3	0.2	0.2	3
591	0.4	0.3		2
592	1			1
701	1			1
702	0.6	0.2		2
703	0.4	0.4		2
704	0.5	0.2	0.2	3
705	1			1
706	0.55	0.3		2
707	0.3	0.3	0.2	3
708	0.5	0.3		2
709	0.4	0.2	0.2	3
710	0.5			1
711	0.75	0.15		2
713	1			1
715	0.3	0.25	0.25	3
716	0.5	0.25		2
718	1			1
727	1			1
733	0.4	0.4		2
758	0.5	0.3		2

	759	0.5			1
R6		0.3	0.2		2
				495	165

77 pedon descriptions

pedon descriptions lack:

- Vegetation
- Slope
- Aspect
- pH
- Pores
- Drainage
- Elevation

BioWest-Riley Project

Attrib/Doc	0.21			Spatial	0.67		Utility	0.68		
Pedon Score	0.08	Map Unit	0.43	Maps	Geo-Ref	3.00	Age	Format	Grade	Interpretations
Description	Density	Description	Transect	3.70	pedons	transects	2.00	3.00	1.00	3.5
0.60	0.14	0.86	0.00		3.00	0.00				

Lab Data
0.02

map units	# of comp	# desc. Req.
1	3	9
2	2	6
3	2	6
4	2	6
5	3	9
6	3	9
7	3	9
8	2	6
9	2	6
10	2	6
11	3	9
12	3	9
13	2	6
14	3	9
15	2	6
16	2	6
17	3	9
18	2	6
19	3	9
20	3	9
21	3	9
22	2	6
23	2	6
30	2	6
31	1	3
32	2	6
34	2	6
35	1	3
36	3	9
37	1	3
39	1	3
41	2	6
42	2	6
43	2	6
44	2	6
45	1	3
47	3	9
48	2	6
		252

35 pedon descriptions
descriptions lacked data for specific pedon descriptions.

vegetation
elevation
slope
aspect
drainage/water table
landform

Green
River

Attrib/Doc	0.18			Spatial	0.60		Utility	0.68		
Pedon Score	0.05	Map Unit	0.43	Maps	Geo-Ref	3.00	Age	Format	Grade	Interpretations
Description	Density	Description	Transect	3.00	pedons	transects	2.00	3.00	1.00	3.5
0.53	0.09	0.86	0.00		3.00	0.00				

map units	# of descrip.	# required	1st compon.	2nd compon.	3rd comp.	acreage	Lab Data
296		6	0.6	0.25		683	0.005
301		3	1			98	
332		21	0.35	0.25	0.25	54810	
333		10	0.4	0.4		14311	
333S		9	0.5	0.3		8866	
334		5	1			5695	
335		9	0.5	0.3		8875	
336		18	0.35	0.45	0.2	23979	
337		13	0.5	0.3	0.2	10935	
338		8	0.25	0.2		7708	
339		12	0.6	0.3		22951	
341		10	0.5	0.25	0.15	3066	
344		7	1			17242	
345		14	0.4	0.35		45556	
347		3	1			675	
349		10	0.4	0.25	0.2	3069	
400		3	1			863	
402		8	0.6	0.3		4540	
403		6	0.5	0.4		1805	
404		6	0.4	0.4		110	
405		0	0			306	
407		3	1			506	
413		6	0.6	0.3		886	
414		6	1			8502	
414S		3	1			756	
415		12	0.35	0.3	0.25	4016	
416		11	0.75	0.15		19339	
417		8	1			22385	
418		5	1			5445	
419		5	1			4150	
421		3	1			236	
422		9	0.5	0.2	0.15	451	
423		7	0.6	0.25		3041	
425		11	0.35	0.3	0.25	3539	
428		6	0.6	0.3		1558	
429		8	1			23178	
430		6	0.5	0.3		826	
434		3	1			146	
436		12	0.6	0.2		29015	
438		9	0.5	0.25		12428	

	439	5	1			4259
	440	10	0.4	0.2	0.15	4537
	441	7	1			14069
	442	5	1			5701
	444	3	1			256
	445	5	1			4105
	446	12	0.5	0.3		23267
S446		9	0.3	0.2	0.2	964
	447	6	1			7141
	448	5	1			4057
	449	13	0.6	0.3		30408
	450	15	0.5	0.25		51895
	451	14	0.4	0.4		49231
	452	13	0.5	0.25		32100
	453	8	0.3	0.3		5873
	454	5	1			4044
	455	7	1			11593
	458	9	0.4	0.3		10069
	459	10	0.25	0.25		27044
	460	5	1			5104
	461	0	0			4951
	462	7	0.6			24529
	463	12	0.4	0.3	0.2	9383
	464	8	0.4	0.4		6317
	465	6	0.3	0.2		2589
	466	12	0.4	0.2		30218
	467	13	0.35	0.2		40658
	468	13	0.4	0.2	0.2	17004
	470	15	0.4	0.3	0.2	19987
	471	6	0.8	0.2		511
	472	7	0.5	0.25		2294
	473	6	0.6	0.3		1161
	474	13	0.4	0.25	0.25	13182
	475	8	0.5	0.35		3316
	476	12	0.25	0.25	0.25	4182
	478	3	1			144
	479	7	1			18167
	480	7	1			17323
	481	7	0.6	0.3		3269
	482	7	0.6	0.3		3163
	483	4	1			1313
483G		6	0.4	0.35		1710
	484	6	0.45	0.45		1125
	485	13	0.5	0.2	0.2	10223
	492	5	1			5525
	494	8	0.4	0.4		5240
	495	13	0.5	0.3		26263
	496	14	0.4	0.4		27130
	497	6	0.6	0.35		1498
	498	9	0.6	0.35		6951

499	8	0.5	0.4		3064
504	8	0.55	0.35		6322
505	9	0.25	0.25	0.25	663
506	8	0.3	0.3		4283
507	6	0.6	0.3		1020
508	4	1			1099
509	12	0.4	0.2	0.15	9302
510	5	1			5798
513	4	0.45			2414
515	6	0.55	0.3		143
520	7	0.6	0.2		2052
522	7	0.6	0.15		5536
523	6	0.6	0.25		647
525	5	1			5635
526	8	0.25	0.2		5437
528	6	0.4	0.2		726
530	6	0.5	0.3		1849
532	6	0.5	0.5		370
536	9	0.4	0.2	0.1	1626
538	9	0.25	0.25	0.25	291
540	6	1			7401
543	3	1			702
544	3	1			315
546	3	1			57
551	9	0.45	0.35		9538
552	6	0.4	0.25		617
553	6	0.5	0.4		177
563	14	0.3	0.3	0.2	19665
575	6	0.5	0.25		51
576	12	0.3	0.3	0.2	8857
579	0	0.6	0.3		
590	9	0.35	0.25	0.2	447
610	9	0.4	0.3	0.2	1442
704	12	0.5	0.2	0.2	6135
705	3	1			286
706	6	0.55	0.3		260
708	6	0.5	0.3		46
710	3	0.5			643
711	7	0.75	0.15		4333
713	4	1			2008
715	9	0.3	0.25	0.25	1055
718	4	1			3834
727	4	1			1901
733	6	0.4	0.4		1262
758	6	0.5	0.3		1139
759	3	0.5			1939
800	0	0			5575
801	9	0.4	0.2	0.2	338
817	14	0.5	0.3		39112
818	13	0.4	0.3		29007

831		6	0.5	0.3	1966
836		7	1		18384
837		13	0.45	0.35	27719
851		14	0.5	0.3	37804
water		0	0		28571
	102	1107			1302452

102 typical pedon descriptions
pedon descriptions
lack:

- Vegetation
- Slope
- Aspect
- pH
- Roots
- Pores
- Drainage
- Elevation

Shirley Basin

Attrib/Doc	0.23			Spatial	0.66		Utility	0.32		
Pedon Score	0.25	Map Unit	0.14	Maps	Geo-Ref	2.90	Age	Format	Grade	Interp.
Description	Density	Description	Transect	3.70	pedons	transects	2.00	1.00	1.50	0
0.71	0.36	0.29	0.00		2.90	0.00				

Map Unit	Elements missing	Pedon points	# desc.	C*D	Ac cpnt	# cpnt	# desc. Req	# of descr. Map unit needs	Lab Data
256	E	14	3	42	?	3	9		0.02
261	all	0	0	0	?	2	6		
1417	all	0	0	0	?	1	3		
1425	E,A,R,P,SD,D,L,V	6	2	12	?	2	6		
1428	E,A,R,P,SD,L,V	6	2	12	?	2	6		
1439	E,P,D	11	2	22	?	2	6		
1450	R,P,D	9	5	45	?	3	9		
1451	E,D,P	11	20	220	?	2	6		
1472	all	0	0	0	?	3	9		
1475	P,E,D	12	3	36	?	2	6		
1476	E,P,D,Re,L,VA,S	7	2	14	?	3	9		
1477	E,L,Re,P	11	13	143	?	1	3		
2000	E,P,R,L,D	9	4	36	?	2	6		
2001	P,D	13	2	26	?	2	6		
2003	P,D,E	12	5	60	?	1	3		
2004	P,D,E	12	1	12	?	1	3		
2005	P,D	13	6	78	?	2	6		
2006	P,D,E	12	4	48	?	1	3		
2007	P,E	12	7	84	?	2	6		
2008		3	1	3	?	2	6		
2009	L,P,E,Re,R	10	3	30	?	1	3		
2010	Cs,E,D	11	3	33	?	2	6		
2011		12	1	12	?	1	3		
2013		14	3	42	?	1	3		
2014	P,R,E,D	11	1	11	?	3	9		
2015	D,E	13	17	221	?	3	9		
2016	D,E	13	2	26	?	1	3		
2018	P	14	3	42	?	1	3		
2019	P,D	13	6	78	?	1	3		
2020	L,V,D,P	11	7	77	?	1	3		
2021	P,D	13	2	26	?	1	3		
2022	P,D	13	4	52	?	1	3		
2023	P,D	13	3	39	?	1	3		
2100	D	14	3	42	?	2	6		
2101	D	14	5	70	?	2	6		
2102	D	13	3	39	?	2	6		
2103	D	14	1	14	?	1	3		
2104	D	14	2	28	?	2	6		
2105	D	14	1	14	?	2	6		

2106	R,P,D	12	5	60	?	1	3
2107	P,D	13	5	65	?	2	6
2108	P,D	13	3	39	?	2	6
2109	P	14	1	14	?	2	6
2110	all	0	0	0	?	1	3
2111	all	0	0	0	?	1	3
2112	P,D	13	5	65	?	1	3
2113	P,E,L,R,Re,D	9	2	18	?	1	3
2114	C,D,E	12	1	12	?	2	6
2115		13	1	13	?	2	6
2117	D	13	4	52	?	2	6
2118	P,D	13	1	13	?	3	9
2119	D	14	2	28	?	3	9
2122		11	3	33	?	2	6
2123	D	14	2	28	?	2	6
2125		13	4	52	?	2	6
2127	P,D,E	12	1	12	?	2	6
2128	P,D	13	1	13	?	1	3
2129	P,D	13	1	13	?	2	6
2130	P,D	13	3	39	?	3	9
2131	D	14	1	14	?	2	6
2132	D	13	2	26	?	1	3
2133	D	14	7	98	?	1	3
2134	D	14	1	14	?	2	6
2140	C,P,Re,D	11	1	11	?	1	3
2143	C,Re,D,T	11	1	11	?	1	3
2145		3	2	6	?	2	6
2146	C,P,A,D	11	1	11	?	3	9
2147	P,D	13	2	26	?	2	6
2148	D	14	5	70	?	2	6
2149	D	14	2	28	?	2	6
2150		5	1	5	?	2	6
2151	D,P	13	7	91	?	2	6
2152	D,P	13	2	26	?	2	6
2153	D	14	1	14	?	2	6
2154	D	14	1	14	?	2	6
2155	D	14	1	14	?	2	6
2156	D,P	13	1	13	?	1	3
2157	D,P	13	1	13	?	2	6
2158	D,P	13	1	13	?	2	6
2159		3	2	6	?	2	6
2162	D	14	1	14	?	3	9
2163		7	2	14	?	1	3
2164		12	5	60	?	1	3
2165	C,P,E	12	2	24	?	3	9
2166	D	14	2	28	?	1	3
2167		1	0	0	?	2	6
2168	D	14	2	28	?	2	6
2169		2	0	0	?	2	6
2170	P,D	13	1	13	?	2	6

2171	A,D	13	3	39	?	2	6
2172		5	1	5	?	2	6
2175		5	1	5	?	1	3
2176	P,D	13	1	13	?	1	3
2177	P,D	13	1	13	?	3	9
2178		0	0	0	?	2	6
2180		12	9	108	?	2	6
2181		12	4	48	?	2	6
2182		1	1	1	?	1	3
2185	P,D	12	4	48	?	2	6
2187	E,P,D	13	6	78	?	2	6
2188	E,P,D,R,P	11	6	66	?	1	3
2189	V,E,P,R	11	2	22	?	2	6
2192	D	14	2	28	?	2	6
2197	D,E,P	13	2	26	?	2	6
2198	D	14	1	14	?	1	3
2199	P,E,D	13	9	117	?	1	3
2200	D,P,R,P,pH	12	6	72	?	1	3
2201	D,Re,E,V	11	5	55	?	1	3
2202	D,V	13	5	65	?	1	3
2204	D,V	13	1	13	?	1	3
2205	all	0	0	0	?	1	3
2206	D,P,R,V	12	18	216	?	1	3
2207	D	12	7	84	?	2	6
2208	R,P,D,E	11	2	22	?	2	6
2210	D,E	13	1	13	?	1	3
2211	D,E	13	2	26	?	2	6
2212	D	14	3	42	?	3	9
2213	D,P	11	4	44	?	2	6
2214		2	2	4	?	2	6
2215		1	1	1	?	3	9
2216	P,D,E	12	1	12	?	2	6
2217		0	1	0	?	2	6
2218		0	1	0	?	3	9
2219	C,T,pH,D,V	10	1	10	?	2	6
2220		1	2	2	?	2	6
2221		1	2	2	?	3	9
2222		2	3	6	?	1	3
2223	E,D	13	1	13	?	2	6
2224		1	1	1	?	2	6
2225		2	5	10	?	1	3
2227	D,P	13	2	26	?	2	6
2228	P,E,R	12	1	12	?	1	3
2229	D	14	1	14	?	1	3
2230	D,P	13	5	65	?	2	6
2231	D,P	13	2	26	?	3	9
2232		1	1	1	?	3	9
2233	C,T,P,D	11	2	22	?	1	3
2234		2	2	4	?	2	6
2235		2	1	2	?	2	6

2236		0	6	0	?	2	6
2237		1	2	2	?	2	6
2239	D,E,P	13	5	65	?	2	6
2240		1	3	3	?	1	3
2241	E,R,P,D,V,L	9	7	63	?	2	6
2242	E,R,P,D,V,L	11	6	66	?	1	3
2243		1	1	1	?	1	3
2244		1	3	3	?	3	9
2245		1	5	5	?	2	6
2246		1	2	2	?	1	3
2247		0	1	0	?	1	3
2248		15	3	45	?	3	9
2249	P	14	3	42	?	3	9
2250		15	2	30	?	2	6
2251		14	2	28	?	1	3
2252	D	13	4	52	?	2	6
2253	D	14	3	42	?	1	3
2257	D,C,T	13	3	39	?	2	6
2258		0	0	0	?	2	6
2264	D	14	3	42	?	3	9
2265	D,P,Re,pH	13	2	26	?	3	9
2266		1	10	10	?	2	6
2267		0	0	0	?	3	9
2268		1	4	4	?	3	9
2269		1	1	1	?	2	6
2270		1	3	3	?	3	9
2271		1	4	4	?	2	6
2272		0	1	0	?	1	3
2273		1	2	2	?	2	6
2274		0	2	0	?	1	3
2275	D	14	1	14	?	1	3
2310	C,P,D,E	11	1	11	?	1	3
2311	E,D,P	12	5	60	?	3	9
2313	E,D,P,R	12	10	120	?	2	6
2317	P,E,D,Cs	11	3	33	?	1	3
2351	P,D,E	12	4	48	?	2	6
2352	D	14	1	14	?	2	6
2354	D	14	2	28	?	2	6
2358	St,C,Cs,pH,Re,R,P	6	2	12	?	3	9
2362	D	14	2	28	?	2	6
2363	D	13	8	104	?	1	3
2366		0	0	0	?	2	6
2367	P,D	14	2	28	?	1	3
		9.53	534	5659			993
			10.60				
Description score:		0.71					
Density score		0.54		Estimated*		0.36	
Pedon score		0.38		Estimated		0.25	
Abor	P,D	13	1				3

Absher		15	3	3
Absher Var.	Cs,R,P,E,D,L	8	2	3
Abston		15	2	3
Adilis	D,R,P	12	1	3
Alcova	D,P	13	9	3
Alcona Taxad.		15	1	3
Almy	D	14	2	3
Almy Taxad.	D	14	1	3
Almy Var.	D	14	2	3
Arnegard Var.	D,P	13	1	3
Bateson	D,P,R	12	12	3
Bateson Var.	D,P,E	12	4	3
Bittercreek	D,P,E	13	3	3
Bittercreek Var.	D	14	1	3
Blackdraw Var.	D	14	1	3
Blackhall	D,P,Re,pH	11	1	3
Blazon	D	14	1	3
Blazon Var.	D,P,E	12	1	3
Boettcher	D,P	13	1	3
Boltus	D,E	13	3	3
Boltus Var.	D,P	13	1	3
Bosler	D	14	1	3
Brokenheart Var.	D,E,P	12	1	3
Brownstow	D,P	13	5	3
Brownstow Var.	D	14	1	3
Center Creek	D	14	1	3
Chaperton	D,P	13	1	3
Chaperton Var.	D	14	1	3
Chipendale Var.	D,E	12	3	3
Cragosen Var.	D,P	13	3	3
Cushool		15	1	3
Debone	D	14	2	3
Delphill	D,P	13	2	3
Delphill Var.	D,P	13	2	3
Diamondville Var.	D	14	1	3
Elk Hollow	D,E	13	3	3
Eltsac Var.	D,P	13	1	3
Fiveoh	D	14	1	3
Fiveoh Var.	D	14	1	3
Forelle	D	14	5	3
Grobutte	D,P	13	2	3
Harol	D,P	13	1	3
Harve	D	14	1	3
Jenkins Taxad.	D	14	1	3
Lap Var.	D,P,E,R	13	2	3
Lisam	D,P	13	2	3

Luhon	D,P,E	12	9	3
Luhon Var.	D,P,E	12	8	3
Lupinto	D,P	13	2	3
McFadden Var.	D	14	2	3
Morling Taxad.	D	14	3	3
Mosby	D,E	13	2	3
Mosby Var.	D	14	1	3
Moyerson	D,P	13	1	3
Paunsaugunt	D,P	13	2	3
Penrose	E,D,P	12	7	3
Pinehill	E,D,P,R	12	9	3
Pinelli	D,P,R,E	11	7	3
Rawlins		15	3	3
Rawlins Var.	D,P	13	2	3
Redcreek Var.	D,P	13	2	3
Red Wash Var.	D,P	13	2	3
Rencot Var.	D,P,R,E	11	1	3
Rentsac Var.	D,P,E	12	7	3
Rock Creek	D	14	7	3
Rodell Var.	D,P	13	1	3
Rootel Taxad.	D,P	13	3	3
Rootel Var.	D,E,P,R	11	1	3
Sagecreek	D	14	1	3
Satanka	D	14	3	3
Satakina Var.	D,P	13	1	3
Shawa	D	14	1	3
Shellcreek Taxad.		15	1	3
Shirley Basin	D	13	11	3
Shirley Basin Var.	D	14	1	3
Spool	D,P	13	6	3
Spool Var.	D,P	13	1	3
Starman Taxad.	D,P	13	1	3
Starman Var.	D,P	13	1	3
Stunner	D,P	13	15	3
Teranch	D,P	13	7	3
Thermopolis	D,P,E,Cs,S,A	11	2	3
Tisworth	D,P	13	4	3
Tisworth Taxad.	D	14	4	3
Tisworth Var.	D	14	2	3
Tresano	D	14	1	3
Tresano Var.	D,P	13	2	3
White River	D	14	3	3
White River Var.	D,E,P	12	2	3
Whubber	D,E,P	13	8	3
Whubber Var.	D	14	1	3
Windill	D,P	13	4	3

Yamac	D	14	1	3
Yamac Var.	D	14	1	3

*Scores were estimated by using 1986 as the required number of pedons. More if acreage of the map units is known.

SaLUT Overland

Attrib/Doc	0.34			Spatial	0.65		Utility	0.82			Lab Data
Pedon Score	0.23	Map Unit	0.59	Maps	Geo-Ref	2.67	Age	Format	Grade	Interp.	0
Desc.	Density	Desc	Transect	3.80	pedons	transects	2.00	3.00	2.50	4.00	
0.86	0.27	0.86	0.32		3.00	2.00					

MU	Elem. Miss.	Pedon points	Number of Pedons	C*D	tran scor	tran points	Acres MU	1 cmpt	2 cmpt	3 cmpt	Req # Des	descr. Need.	Trans req
113		13	2	26	0	0	5170.5	1			5	3	40
119		13	4	52	0	0	9901.4	0.5	0.4		9	5	50
114		13	4	52	0	0	1216.3	0.5	0.4		6	2	30
203		13	2	26	0	0	972.8	0.4	0.3		6	4	30
208		13	3	39	0	0	9909.3	0.45	0.35		9	6	50
220		13	1	13	0	0	355.8	1			3	2	30
221		13	2	26	0	0	2666.6	0.6	0.25		7	5	40
225		13	2	26	0	0	15400	0.5	0.3		11	9	60
232		13	4	52	0	0	935.7	0.5	0.15	0.15	9	5	30
233		13	3	39	0	0	5660.6	0.4	0.3		8	5	40
234		13	3	39	0	0	4052.1	0.35	0.25	0.15	11	8	40
235		13	3	39	0	0	3695.2	0.45	0.3		8	5	40
236		13	3	39	3	10	15280	0.35	0.2	0.2	13	10	60
237		13	2	26	0	0	2956.9	0.4	0.3		7	5	40
241		13	3	39	0	0	1992.4	0.4	0.2	0.2	9	6	30
242		9	3	27	3	25	6438.6	0.5	0.3		8	5	50
245		0	0	0	5	15	3093.5	0.3	0.25	0.2	9	9	40
245G		13	2	26	3	10	365.4	0.5	0.3		6	4	30
245R		13	2	26	3	11	2447.3	0.5	0.3		7	5	40
247		13	2	26	3	10	8595.5	0.4	0.25	0.2	12	10	50
249		13	1	13	3	22	635.7	0.5	0.3		6	5	30
252		13	2	26	0	0	7667.2	0.4	0.3		8	6	50
264		0	0	0	3	14	9443.8	1			6	6	50
267		0	0	0	3	14	820.5	0.5	0.4		6	6	30
269		13	1	13	3	14	2706.5	0.5	0.4		8	7	40
273		0	0	0	3	18	16267	0.5	0.3		11	11	60
275		13	2	26	3	16	3194.7	0.5	0.4		8	6	40
279		13	2	26	0	0	2170.9	0.5	0.3		7	5	40
281		0	0	0	3	12	11730	0.4	0.2		9	9	60
282		0	0	0	3	12	2023.9	1			4	4	40
283		0	0	0	3	13	1587.9	0.5	0.3		6	6	30
284		0	0	0	3	12	13760	0.4	0.2		9	9	60
285		13	3	39	3	18	13051	0.5	0.3		9	6	60
286		0	0	0	3	21	5038.3	1			5	5	40
287		0	0	0	3	12	1638.4	0.6	0.3		6	6	30
289		0	0	0	3	12	11321	0.5	0.3		9	9	60
295R		13	3	39	0	0	2279.2	0.4	0.3	0.15	9	6	40
292		13	1	13	3	12	6147.7	0.7	0.2		9	8	50
295		13	3	39	3	15	9474.5	0.4	0.25	0.2	12	9	50
296		13	5	65	3	23	16449	0.6	0.25		11	6	60
297		13	1	13	1	10	2363.6	1			4	3	40
301		13	1	13	0	0	1	1			3	2	30
313		13	2	26	3	10	1901.5	0.4	0.3		6	4	30
332		13	2	26	3	38	32477	0.35	0.25	0.25	19	17	60
333		13	2	26	3	10	32874	0.4	0.4		14	12	60

333S	13	2	26	3	10	15421	0.5	0.3		11	9	60
334	13	1	13	3	21	255.5	1			3	2	30
335	13	2	26	3	10	221.6	0.5	0.3		6	4	30
336	13	1	13	3	31	7739	0.35	0.25	0.2	12	11	50
337	0	0	0	3	5	1	1			3	3	30
338	13	2	26	3	10	1	1			3	1	30
341	13	6	78	3	22	1	1			3	0	30
339	13	9	117	3	22	2324	0.6	0.3		7	0	40
344	0	0	0	3	10	1845.6	1			4	4	30
345	13	1	13	3	41	1	1			3	2	30
347	0	0	0	3	21	493.5	1			3	3	30
349	13	4	52	0	0	229.2	0.4	0.25	0.2	9	5	30
350	0	0	0	3	23	3668.5	0.45	0.3	0.15	11	11	40
404	13	1	13	3	10	6618	0.5	0.4		8	7	50
407	13	1	13	3	13	1	1			3	2	30
408	13	1	13	3	10	2803.9	1			4	3	40
413	13	2	26	0	0	1	1			3	1	30
414	13	1	13	3	10	1	1			3	2	30
414S	13	1	13	0	0	1	1			3	2	30
415	13	1	13	3	28	1	1			3	2	30
416	13	3	39	3	18	1	1			3	0	30
417	13	1	13	3	10	1	1			3	2	30
418	13	2	26	0	0	1	1			3	1	30
419	13	1	13	0	0	1	1			3	2	30
423	13	2	26	0	0	1	1			3	1	30
425	13	5	65	3	34	4770.9	0.35	0.3	0.25	12	7	40
428	13	1	13	0	0	3676.5	0.6	0.3		8	7	40
429	13	1	13	3	10	9525	1			6	5	50
430	13	2	26	0	0	926.4	0.5	0.3		6	4	30
431	13	1	13	0	0	3012.9	1			4	3	40
434	0	0	0	3	20	10372	1			7	7	60
436	13	1	13	3	15	2953.6	0.6	0.2		7	6	40
438	13	4	52	3	33	13214	0.5	0.25		9	5	60
439	13	2	26	0	0	170.1	1			3	1	30
440	13	1	13	3	35	46653	0.4	0.2	0.15	18	17	60
441	13	2	26	3	27	3072	1			4	2	40
442	13	1	13	0	0	11207	1			7	6	60
444	13	1	13	0	0	1	1			3	2	30
445	13	1	13	3	17	5046.7	1			5	4	40
446	13	2	26	3	43	1858.5	0.5	0.3		6	4	30
S446	13	4	52	3	21	4829.5	0.3	0.2	0.2	10	6	40
447	13	1	13	0	0	4334.3	1			5	4	40
448	13	2	26	0	0	1301.2	1			4	2	30
449	13	3	39	3	33	17271	0.6	0.3		12	9	60
450	13	2	26	3	36	1269.7	0.5	0.25		6	4	30
451	13	2	26	3	22	1924.1	0.4	0.4		6	4	30
452	13	4	52	3	10	834.8	0.5	0.25		6	2	30
453	13	1	13	3	31	19533	0.3	0.3		10	9	60
454	13	3	39	3	10	3924.2	1			4	1	40
455	13	2	26	0	0	1	1			3	1	30
456	13	1	13	0	0	4722.2	0.5	0.25		8	7	40
457	13	1	13	0	0	1464.3	1			4	3	30
458	13	4	52	3	10	168.9	0.4	0.3		6	2	30
459	13	3	39	3	10	4747.8	0.25	0.25		8	5	40
462	13	1	13	3	20	1	1			3	2	30
463	13	1	13	3	43	79025	0.4	0.3	0.2	24	23	60
464	13	2	26	3	10	2658.2	0.4	0.4		8	6	40

465	13	2	26	0	0	1	1			3	1	30
466	13	3	39	3	10	9169.3	0.4	0.2	0.2	12	9	50
467	0	0	0	3	15	20825	0.35	0.2	0.2	16	16	60
468	13	3	39	3	10	8642.3	0.4	0.2	0.2	12	9	50
470	13	3	39	3	10	8091.7	0.4	0.3	0.2	12	9	50
471	13	1	13	0	0	1	1			3	2	30
472	13	1	13	3	15	2120.2	0.5	0.25		7	6	40
473	13	2	26	0	0	2116.5	0.6	0.3		7	5	40
474	13	3	39	3	19	8914.6	0.4	0.25	0.25	12	9	50
475	13	1	13	3	15	1	1			3	2	30
476	0	0	0	3	15	1351.7	0.25	0.25	0.25	9	9	30
479	0	0	0	3	10	14668	1			7	7	60
480	13	1	13	3	10	11110	1			7	6	60
481	13	2	26	3	10	6393.5	0.6	0.3		8	6	50
482	13	1	13	0	0	219.4	0.6	0.3		6	5	30
483	13	1	13	0	0	5670.7	1			5	4	40
483G	0	0	0	3	12	1	1			3	3	30
484	13	2	26	0	0	4980	0.45	0.45		8	6	40
485	0	0	0	3	23	1	1			3	3	30
492	13	1	13	3	10	897.6	1			3	2	30
493	13	2	26	0	0	895	1			3	1	30
494	13	5	65	3	22	1	1			3	0	30
495	13	1	13	3	55	40499	0.5	0.3		15	14	60
496	13	1	13	3	47	7398.2	0.4	0.4		8	7	50
497	13	9	117	3	13	437.7	0.6	0.35		6	0	30
498	13	2	26	3	12	26643	0.6	0.35		13	11	60
499	13	2	26	3	12	1	1			3	1	30
504	13	3	39	3	20	194.6	0.55	0.35		6	3	30
505	13	5	65	0	0	424	0.25	0.25	0.25	9	4	30
506	13	2	26	0	0	1	1			3	1	30
507	13	3	39	3	15	686.1	0.6	0.3		6	3	30
508	13	1	13	0	0	1150.6	1			4	3	
509	13	2	26	3	22	1	1			3	1	30
510	13	4	52	3	24	1	1			3	0	30
513	13	1	13	0	0	1	1			3	2	30
515	13	2	26	0	0	1	1			3	1	30
528	13	4	52	0	0	1	1			3	0	30
530	13	2	26	0	0	1	1			3	1	30
540	13	3	39	0	0	1	1			3	0	30
543	13	1	13	0	0	1479.6	1			4	3	30
544	13	1	13	0	0	333.7	1			3	2	30
551	13	2	26	3	12	4020.6	0.45	0.35		8	6	40
553	13	1	13	0	0	1	1			3	2	30
555	13	1	13	0	0	3.1	1			3	2	30
563	13	3	39	3	10	21241	0.3	0.3	0.2	15	12	60
575	13	1	13	0	0	1749.2	0.5	0.25		6	5	30
576	13	4	52	3	17	1	1			3	0	30
592	0	0	0	0	0	118.5	1			3	3	30
610	13	2	26	3	25	1	1			3	1	30
678	13	3	39	3	10	1497.6	1			4	1	30
704	13	2	26	3	13	1	1			3	1	30
705	13	1	13	0	0	243.3	1			3	2	30
706	13	1	13	0	0	1	1			3	2	30
708	13	1	13	0	0	1	1			3	2	30
710	13	1	13	0	0	1	1			3	2	30
711	13	3	39	0	0	14.8	0.75	0.15		6	3	30
715	13	4	52	0	0	267.8	0.3	0.25	0.25	9	5	30

718	13	1	13	3	11	1	1			3	2	30
727	13	1	13	3	12	1	1			3	2	30
733	13	2	26	0	0	1	1			3	1	30
758	13	2	26	0	0	25.2	0.5	0.3		6	4	30
759	13	1	13	0	0	88.3	0.5	0.25		6	5	30
761	13	1	13	0	0	264.8	1			3	2	30
817	13	2	26	3	12	1	1			3	1	30
818	13	3	39	3	11	1	1			3	0	30
831	13	2	26	3	9	442.6	0.5	0.3		6	4	30
836	13	2	26	3	12	2552.7	1			4	2	40
837	13	4	52	3	12	17247	0.45	0.35		11	7	60
851	13	5	65	3	10	1222.9	0.5	0.3		6	1	30
852	0	0	0	3	45	17567	0.35	0.35	0.15	14	14	60
853	13	3	39	3	30	31366	0.45	0.2	0.15	17	14	60
855	13	2	26	3	28	5725.4	0.4	0.4		8	6	40
856	13	5	65	3	18	11502	0.45	0.35		10	5	60
857	13	2	26	3	25	7974.5	0.7	0.15		9	7	50
858	13	1	13	0	0	868.3	1			3	2	30
859	13	3	39	3	15	3129.9	0.3	0.25	0.25	9	6	40
860	13	2	26	3	10	760	0.35	0.2	0.2	9	7	30
900	13	3	39	3	10	3498.7	0.6	0.2		7	4	40
901	13	3	39	3	10	2222.7	1			4	1	40
902	0	0	0	3	15	6304.5	0.5	0.4		8	8	50
903	13	4	52	3	10	6221.7	0.5	0.3		8	4	50
904	13	8	104	3	20	7805.1	1			6	0	50
905	13	2	26	3	11	8229.5	0.5	0.3		9	7	50
907	13	3	39	3	10	6563.4	0.5	0.3		8	5	50
910	0	0	0	3	13	1386.6	0.4	0.35		6	6	30
911	13	2	26	3	10	9317.3	0.6	0.2		9	7	50
912	13	2	26	0	0	986.2	1			3	1	30
913	13	2	26	0	0	2491.4	0.6	0.3		7	5	40
914	13	2	26	0	0	1480.5	1			4	2	30
926	13	3	39	3	12	1	1			3	0	30
921	13	1	13	0	0	638.1	1			3	2	30
923	13	1	13	0	0	3766.6	0.4	0.3	0.15	11	10	40
951	13	6	78	3	10	7414.9	0.5	0.3		8	2	50
952	0	0	0	3	16	2111.8	0.4	0.2		6	6	40
953	13	2	26	3	10	5797.7	1			5	3	40
954	13	6	78	3	10	10691	0.5	0.2	0.2	13	7	60
1301	0	0	0	3	10	6074.3	0.6	0.25		8	8	50
1309	0	0	0	3	11	14	0.5	0.3		6	6	30
1320	13	3	39	0	0	30.6	0.35	0.15		6	3	30
1321	0	0	0	3	12	2331.1	1			4	4	40
1401	0	0	0	3	23	4887.9	1			5	5	40
1405	13	1	13	0	0	12164	0.4	0.35		10	9	60
200	0	0	0	0	0	1784	0.5	0.4		6	6	30
294	0	0	0	0	0	406.7	1			3	3	30
330	0	0	0	0	0	23	1			3	3	30
400	0	0	0	0	0	1424.3	1			4	4	30
402	0	0	0	0	0	3439.3	0.6	0.3		8	8	40
460	0	0	0	0	0	31208	1			9	9	60
461	0	0	0	0	0	797.4	0			0	0	30
478	0	0	0	0	0	18.5	1			3	3	30
861	0	0	0	0	0	2881.5	0.4	0.25	0.2	10	10	40
920	0	0	0	0	0	7508.6	0.5	0.25		8	8	50
922	0	0	0	0	0	2190.4	1			4	4	40
1400	0	0	0	0	0	297.6	1			3	3	30

1402	0	0	0	0	0	2787.5	0.6	0.2	7	7	40
1406	0	0	0	0	0	86.8	1		3	3	30
908	0	0	0	0	0	3085.1	1		4	4	40
Total/Average	10.31	399	5175	390	2220	1E+06			1428	1044	8520
			12.97		5.69						
Description score:	0.86		Tran. Description score		0.38						
Density score	0.27		Tran. Den.		0.26						
Pedon score	0.23		Tran. Score		0.32						

Sage Creek

Attrib Doc 0.25				Spatial 0.60			Utility 0.69			
Pedon Score	0.17	Map Unit	0.39	Maps	Geo-Ref	3.00	Age	Format	Grade	Interp.
Descr.	Density	Descr.	Transect	3.00	pedons	transects	1.00	3.20	2.50	3.00
0.97	0.17	0.79	0.00		3.00	0.00				

Map Unit	Elem. Miss.	Pedon points	# Pedons	3rd comp.	1st comp.	2nd comp.	Acres cmpt	# cpmt	Req # Des	# descr. Need
13					1		377		3	
100					1		286		3	
101					0.5	0.3	1012		6	
102					0.45	0.35	6015		8	
103				0.2	0.4	0.25	5507		12	
104					0.6	0.25	2425		7	
105					0.4	0.25	4932		8	
106					0.5	0.2	2472		7	
107					0.5	0.35	1183		6	
108					0.6	0.25	274		6	
109					0.5	0.3	628		6	
110					0.55	0.25	1234		6	
111					0.5	0.3	304		6	
112					0.45	0.3	1239		6	
200					1		1464		4	
201					0.5	0.3	582		6	
202					0.5	0.3	2328		7	
203					0.4	0.3	1890		6	
204					0.6	0.25	1842		7	
205					0.5	0.3	155		6	
206					0.35	0.3	283		6	
207					0.5	0.3	2302		7	
208					0.45	0.35	1037		6	
209					0.5	0.3	5186		8	
210					0.5	0.35	772		6	
211					0.45	0.35	2101		6	
212					0.6	0.25	1692		7	
213					0.5	0.3	608		6	
214					0.4	0.3	123		6	
215					0.4	0.25	639		6	
216					0.45		286		3	
217					0.6	0.25	2583		7	
218					1		2822		4	
219					0.5	0.25	2550		7	
220					1		701		3	
221					0.6	0.25	2137		7	
222					0		1075		0	
223					0		1327		0	
224					1		1014		4	

227			1		2074		4
300			0.35	0.3	3357		8
301			0.5	0.3	9579		9
302			0.4		11193		5
303			0.5		30883		7
304			0.4	0.25	12831		9
305			0		9884		0
306			0.5	0.3	1047		6
307			0.5	0.3	10545		9
308			0.4	0.3	8679		8
309			0.5	0.35	3536		8
311			0		255		0
314			1		6573		5
315			0.5	0.35	2771		7
318			0.5	0.35	1243		6
319			0.5	0.35	2161		7
400			0		2148		0
401			0		2519		0
403			0		1350		0
water			0		410		0
	14.5	56			2E+05		323
						Lab Data	
						0.01	

TRC (Overland)

Attrib Doc	0.40			Spatial	0.61		Utility	0.57		
Pedon Score	0.32	Map Unit	0.58	Maps	Geo-Ref	2.27	Age	Format	Grade	Interp
Description	Density	Description	Transect	3.80	pedons	transects	2.00	3.00	3.00	0.00
0.83	0.39	0.86	0.31		2.40	2.00				

Map Unit	Elem miss	Pedon points	Pedon's	C*D	tran scor	tran points	Ac cmpt	# cpmt	# des re	# of transect Map unit needs
119	L,D,Cs,pH,Re,R,P	7	1	7	0	0	?	2	6	30
200	E,Re,R,P	11	2	22	7	1	?	2	6	30
202	R,P	13	7	91	5	25	?	2	6	30
208	R,P,D	13	5	65	0	0	?	2	6	30
207		0	0	0	6	6	?	2	6	30
205	R,P	13	3	39	0	0	?	2	6	30
216	R,P	13	1	13	0	0	?	1	3	30
217	R,P	13	2	26	10	6	?	2	6	30
233	P,D	13	1	13	0	0	?	2	6	30
235	P,E,R	12	3	36	2	2	?	2	6	30
241	P,R	13	2	26	2	10	?	3	9	30
252		0	0	0	9	3	?	3	9	30
253	P,E,R	12	6	72	6	32	?	3	9	30
260	P,R	13	3	39	6	15	?	2	6	30
261	P,E,R	12	2	24	5	1	?	2	6	30
263	P	14	1	14	0	0	?	2	6	30
264	P,E,R	12	3	36	2	7	?	1	3	30
275	P,E,R	12	2	24	5	13	?	2	6	30
281	P,E,R	13	2	26	0	0	?	2	6	30
283	P,E	13	8	104	0	0	?	2	6	30
285		0	0	0	2	7	?	1	3	30
292	P,R	13	5	65	0	0	?	2	6	30
300	R,E,P	12	1	12	1	2	?	2	6	30
319	R,P	13	3	39	3	2	?	2	6	30
332	P,R	13	5	65	1	1	?	2	6	30
333	P,R	13	5	65	3	4	?	1	3	30
333S	S,A,P	12	1	12	8	2	?	1	3	30
334	P,R	13	6	78	2	2	?	1	3	30
336	P,R	13	5	65	0	0	?	2	6	30
338	P,R	13	2	26	0	0	?	3	9	30
339	P,R,E,A,S	11	1	11	0	0	?	2	6	30
400		0	0	0	2	1	?	1	3	30
402		0	0	0	0	0	?	2	6	30
411	P,R,E	12	1	12	0	0	?	1	3	30
415	P,R	13	8	104	9	7	?	3	9	30
425	P	14	11	154	0	0	?	3	9	30
434	P,R	13	6	78	1	1	?	1	3	30
436	P,R	13	8	104	11	17	?	2	6	30
437		0	0	0	4	8	?	2	6	30
438	R,P	13	10	130	8	17	?	2	6	30

440	R,P,E	13	8	104	0	0	?	3	9	30
446	R,P	13	2	26	10	12	?	2	6	30
447	D,E,P	12	1	12	9	2	?	1	3	30
448	D,E,P	12	5	60	0	0	?	1	3	30
449	R,P	13	3	39	2	14	?	1	3	30
451	R,P	13	4	52	4	5	?	2	6	30
452	D,E,P	12	8	96	1	2	?	2	6	30
455	P	14	1	14	0	0	?	1	3	30
456		0	0	0	5	8	?	2	6	30
459	D,E,P	13	2	26	8	2	?	2	6	30
463	R,P	13	2	26	0	0	?	3	9	30
464	R,P	13	1	13	0	0	?	2	6	30
466	R,P	13	2	26	1	1	?	2	6	30
467	R,P,R	13	3	39	9	10	?	2	6	30
468	D,P	13	1	13	1	1	?	3	9	30
470	D,P	13	6	78	0	0	?	3	9	30
472	D,P,R	12	1	12	6	3	?	2	6	30
474		0	0	0	6	3	?	3	9	30
479	D,P,R	12	2	24	0	0	?	1	3	30
481	D,P	13	2	26	9	4	?	2	6	30
483	P,R	13	2	26	10	7	?	1	3	30
484	P,R	13	2	26	0	0	?	2	6	30
495	D,A,P,R	12	2	24	5	3	?	2	6	30
509	D,E,P	12	5	60	0	0	?	2	6	30
563	D,E,P	13	10	130	1	6	?	3	9	30
800		0	0	0	1	4	?	0	0	30
837	D,E,P	12	1	12	5	27	?	2	6	30
855	D,E,P	12	4	48	2	6	?	2	6	30
856	D,E,P	12	1	12	1	2	?	2	6	30
900	D,E,P	12	10	120	1	2	?	2	6	30
912		0	0	0	7	12	?	1	3	30
954	S,A,D,P	11	3	33	0	0	?	3	9	30
1016	D,P	13	1	13	6	10	?	1	3	30
1203	E,A,P	12	3	36	0	0	?	2	6	30
1241	P,R	13	3	39	3	43	?	3	9	30
1301	E,P,R,A	13	10	130	6	52	?	2	6	30
1305	P,A	13	3	39	1	1	?	2	6	30
1306	P,R	13	2	26	5	6	?	2	6	30
1309	P,R,pH	12	2	24	1	2	?	2	6	30
1323	P,R,pH	12	1	12	8	7	?	2	6	30
1400		0	0	0	8	36	?	2	6	30
1401	A,Re,pH,P,R	10	1	10	9	43	?	1	3	30
1402	E,A,P,R	11	2	22	5	49	?	2	6	30
1403		0	0	0	4	32	?	2	6	30
1404	A,Re,pH,P,R	12	13	156	2	35	?	2	6	30
1405	P,Re	13	3	39	9	27	?	2	6	30
1406	P	14	1	14	9	65	?	1	3	30
1407	E,P,R	12	2	24	1	8	?	1	3	30
1408	E,P,R	12	5	60	0	0	?	3	9	30
1409	A,E,S,D,P,R	8	2	16	3	60	?	1	3	30
1411		12	3	36	6	14	?	2	6	30
1412	E,P,R	12	6	72	5	30	?	2	6	30
1413	E,P,R	12	5	60	0	1	?	3	9	30
1415	P,R	13	5	65	3	45	?	2	6	30
1416	P,R	13	5	65	11	9	?	2	6	30
1417	P,R	12	9	108	4	50	?	1	3	30
1420		12	6	72	9	8	?	2	6	30

1421	V,A,S,D,P,R	10	2	20	12	6	?	2	6	30
1422	E,P	13	4	52	0	0	?	3	9	30
1423	R,P	13	1	13	0	0	?	1	3	30
1425	R,P,E	12	2	24	0	0	?	2	6	30
1426	R,P	13	1	13	1	4	?	3	9	30
1427	R,P	13	7	91	10	10	?	3	9	30
1428	R,P,E	12	2	24	0	2	?	2	6	30
1429	R,P,E	12	11	132	1	16	?	3	9	30
1430	R,P,E	12	5	60	5	2	?	1	3	30
1431	R,P,E,Re	12	5	60	0	3	?	2	6	30
1435	R,P,E	12	8	96	5	14	?	3	9	30
1434	R,P	13	4	52	5	36	?	1	3	30
1436		13	7	91	0	0	?	2	6	30
1437	A,D,Re,pH,R,P	11	13	143	7	5	?	2	6	30
1438	Re,R,P	12	11	132	1	7	?	2	6	30
1439		12	5	60	11	3	?	2	6	30
1441		13	17	221	0	0	?	2	6	30
1442		12	7	84	0	0	?	3	9	30
1443		12	3	36	8	3	?	2	6	30
1444		13	3	39	0	0	?	3	9	30
1445		13	11	143	0	0	?	2	6	30
1446		13	20	260	11	1	?	2	6	30
1450		12	8	96	10	3	?	3	9	30
1451		12	15	180	1	10	?	2	6	30
1452		13	6	78	2	13	?	3	9	30
1453		12	8	96	5	14	?	3	9	30
1454		12	4	48	0	0	?	2	6	30
1455		12	6	72	8	29	?	3	9	30
1456		12	3	36	0	0	?	3	9	30
1457		12	4	48	2	33	?	3	9	30
1458		13	3	39	8	3	?	2	6	30
1459		10	3	30	5	30	?	3	9	30
1460		14	3	42	0	0	?	3	9	30
1465		13	8	104	10	1	?	3	9	30
1467		12	4	48	0	0	?	1	3	30
1469		12	17	204	0	0	?	1	3	30
1470		13	1	13	10	20	?	2	6	30
1471		13	3	39	9	17	?	3	9	30
1472		12	8	96	5	20	?	3	9	30
1473		12	2	24	8	3	?	3	9	30
1474		12	4	48	3	5	?	2	6	30
1475		12	12	144	5	80	?	2	6	30
1476		13	3	39	5	50	?	3	9	30
1477		12	1	12	7	3	?	1	3	30
1478		12	13	156	9	30	?	3	9	30
1479		12	3	36	7	36	?	2	6	30
1480		13	3	39	10	1	?	3	9	30
1481		13	12	156	0	0	?	3	9	30
1482		14	2	28	0	0	?	2	6	30
1483		13	5	65	11	18	?	2	6	30
1484		13	7	91	5	23	?	3	9	30
1486		13	3	39	9	2	?	3	9	30
1491		13	5	65	8	7	?	3	9	30
1492		13	35	455	7	18	?	3	9	30
1494		12	17	204	8	7	?	2	6	30
1496		12	38	456	2	17	?	2	6	30
1498		12	5	60	9	1	?	2	6	30

1499	13	6	78	0	0	?	1	3	30
	11.46	748	9322	3.92	1567		322	966	4650
			12.46						
Description score:	0.83								
Density score	0.77		Estimated *:		0.39				
Pedon score	0.64		Estimated :		0.32				

Battlespring	12	3	6	27
Bittercreek	13	3	5	1
Blackhall	13	5	8	4
Blazon	13	15	7	10
Blazon Var.	13	2	0	0
Boetcher	13	2	0	0
Boltus	13	6	0	0
Brownspark	0	0	0	0
Brownsto	12	27	11	1
Busby	12	1	0	0
Cathedral	12	1	0	0
Cambarge	13	4	10	6
Chaperton	13	7	0	0
Cheadle	12	2	7	1
Chrisman	12	2	9	1
Corlett	12	3	11	1
Cowdrey	13	3	8	1
Cragosen	13	3	0	0
Cumulic Cryaquolls	14	5	0	0
Cumulic Haploborolls	14	3	0	0
Cushools	13	2	0	0
Dawdy	11	1	5	1
Debone	13	6	9	15
Delphill	0	0	9	9
Diamondville	13	5	0	0
Dinco	0	0	0	0
Dines	13	5	8	2
Dunkle	13	3	9	13
Echemoor	13	3	0	0
Evanston	13	7	10	13
Eversole	13	5	0	0
Fivehole	0	0	0	0
Forelle	13	10	7	5
Fraddle	12	5	9	23
Gausid	0	0	0	0
Glendive	13	2	0	0
Gasson	12	4	0	0
Granite	13	2	10	8
Gray Point	12	5	0	0
Greyback	12	2	10	1
Grieves	0	0	0	0
Haggerty	13	14	0	0

Hatermus	0	0	0	0
Haterton	13	10	9	5
Harve	13	5	0	0
Hemering	13	1	0	0
Hesperus	13	9	7	15
Hoofle Var.	12	5	10	8
Horsley	13	12	5	2
Huguston	13	6	6	3
Inchau	13	4	0	0
Jansley	13	3	0	0
Kandaly	13	7	8	3
Kandaly Var.	13	2	10	2
Kimmons	14	9	0	0
Laclede	13	3	9	1
Laney	0	0	11	2
Laney Var.	13	2	0	0
Leavitt	12	5	0	0
Leckman	13	4	12	2
Lotis	0	0	0	0
Luhon	13	30	9	8
Lupinto	12	38	5	1
Lupinto Var.	12	3	0	0
McCullen	13	1	0	0
McFaden	11	6	0	0
Monte	13	3	0	0
Monte Var.	0	0	0	0
Neosh	0	0	0	0
Otterson	0	0	0	0
Pagoda	13	14	7	2
Pepal	13	3	8	3
Peyton	13	6	9	8
Pinelli	12	8	4	1
Piomoses	13	3	0	0
Pishkum	0	0	0	0
Rawlins	13	8	0	0
Redwash	12	3	0	0
Redcreek	12	3	8	2
Rencot	0	0	0	0
Rentsac	13	20	11	3
Rock River	13	30	9	7
Rock River Var.	0	0	0	0
Rogert	13	3	7	1
Rootel	13	6	0	0
Ryan Park	12	5	0	0
Sage Creek	12	12	7	6
San Arcacio	12	4	0	0
Sand Branch	12	10	10	15
Satanka	12	3	7	2
Screggs	13	3	0	0
Seaverson	0	0	0	0
Shell Creek	10	15	7	6
Shinbara	13	9	8	6
Spool	11	2	0	0
Stunner Var.	0	0	0	0
Taglake Var.	12	2	11	4
Tassellman	13	2	0	0
Teagulf	13	6	0	0

Terada	12	3	0	0
Thayer	13	3	0	0
Thermopolis	13	3	13	1
Toby	12	3	0	0
Tresano	13	12	7	125
Tridell	13	9	0	0
Unson	0	0	0	0
Vabem	0	0	0	0
Vible	12	7	0	0
Wamsutter	10	5	0	0
Washakie	0	0	0	0
Westvaco	13	7	10	10
Winton	13	6	8	1
Worfman Var.	12	3	0	0
Yamac	12	9	0	0
Youjay	11	4	0	0
Zeona	12	11	11	20
Ziliian	13	4	0	0
Zillman	12	4	0	0
Zirkel	0	0	0	0

Lab Data
0

*Scores estimated by using 1932 as the required number of pedons.More if acreage known.

Grass Creek (Hot Springs Co.)

Attrib Doc	0.45			Spatial	0.65		Utility	0.80	
Pedon Score	0.31	Map Unit	0.75	Maps	Geo-Ref	3.00	Age	Format	Grade
Desc	Density	Description	Transect	3.50	pedons	transects	2.00	3.00	2.70
0.80	0.39	0.73	0.78		3.00	3.00			

map units	# desc	1st compon.	2nd compon.	3rd comp.	acreage	# desc req.	# cmpt	Lab Data
11		1					1	0.005
11L		1					1	
11T		0.65	0.25				2	
45		0.5	0.25				2	
46	1	0.45	0.3				2	
47	3	0.55	0.25	0.15			3	
60	2	0.45	0.45				2	
67	2	0.55	0.2				2	
68	2	0.5	0.25				2	
69	1	1					1	
70	1	1					1	
71	2	0.6	0.25				2	
72	2	0.4	0.35				2	
73	1	0.4	0.3	0.2			3	
74		0.45	0.3				2	
75	1	0.4	0.35				2	
93	1	0.5	0.3				2	
102		0					0	
109	1	0.45					1	
110	1	0.5	0.35				2	
111	2	0.25	0.25				2	
112	1	0.25	0.25				2	
190	2	0.45	0.3				2	
192	3	0.3	0.25				2	
243	2	0.5	0.3				2	
244		1					1	
245	1	1					1	
246	2	0.45	0.25				2	
247		1					1	
315		0.5	0.3				2	
322	2	0.45	0.3				2	
323	1	1					1	
324		0.4	0.4				2	
325	3	0.3	0.3	0.2			3	
345	2	0.45	0.35				2	
346	1	0.3	0.3	0.2			1	
360	2	0.5	0.3				2	
371		0.4	0.35				2	
372	2	0.5	0.25				2	

373	3	0.45	0.35		2
375	3	0.3	0.25	0.25	3
382	1	0.4			1
383	1	0.3	0.2		2
389	1	0.5	0.3		2
393		0.45	0.35		2
394		0.6	0.2		2
398	3	0.3	0.25	0.25	3
410	2	0.3	0.25	0.25	3
411	2	0.35	0.2		2
426	3	0.5	0.4		2
445	5	0.45	0.35		2
446	1	0.25	0.2		2
447		1			1
448	2	1			1
449	1	0.45			1
450	7	0.4	0.4		2
490	1	0.4	0.35		2
546	2	0.35	0.2		2
572	3	0.5	0.25		2
590	1	0.5			1
601	4	0.35	0.3	0.2	3
602	2	0.5	0.3		2
604	1	0.5	0.3		2
606	2	0.4			1
645		0.4	0.25	0.15	3
650	1	1			1
671	1	0.35			1
675		0.4	0.35		2
700	1	0.5	0.3		2
701	2	0.5	0.3		2
702	2	0.45	0.35		2
703	1	0.5	0.3		2
705	2	0.5	0.3		2
706		0.35	0.25	0.2	3
708	1	0.4	0.2	0.2	3
709	3	0.4	0.25	0.2	3
710	3	0.4	0.25	0.2	3
720	1	0.45			1
722	1	1			1
723	4	0.4	0.35		2
724	3	0.4	0.35		2
725	2	0.4	0.35		2
730	1	0.45	0.35		2
732	2	0.4			1
735	3	0.45	0.35		2
736	2	0.5	0.3		2
737		0.4	0.35		2
749	2	0.45	0.35		2
750		0.5	0.3		2

751	1	0.45	0.2			2
752		1				1
753	3	0.4	0.4			2
802	2	0.4				1
804		0.35				1
806		0.5	0.2			2
808	2	0.3	0.25			2
810	1	0.4	0.2	0.2		3
812		0.5	0.3			2
813	6	0.7	0.3			2
814	2	0.35	0.25	0.2		3
815	2	0.7	0.15			2
816	2	0.6	0.2			2
818		0.55	0.25			2
820	2	0.4	0.4			2
822	3	0.45	0.2	0.2		3
850	3	0.5	0.25			2
854	1	0.5	0.35			2
870	3	0.5	0.25			2
872	1	0.3	0.25			2
876	2	0.4	0.4			2
902	3	0.5	0.2			2
825		0.5	0.3			2
910	3	0.3	0.25	0.25		3
920	3	0.25	0.25	0.25		3
929	1	0.6				1
930	3	0.4	0.3	0.15		3
931	2	0.45	0.35			2
939	1	0.35				1
940		0.5	0.3			2
939		0.65				1
total:78+	188				687	229
	266					

78 pedon descriptions

There are about 1880 transect points

pedon descriptions lack:

Vegetation

Slope

Aspect

pH

Pores

Drainage

Elevation

Park County

Attrib Doc 0.38				Spatial 0.63			Utility 0.48			
Pedon Score 0.27		Map Unit 0.62		Maps	Geo-Ref 2.75		Age	Format	Grade	Interp
Desc	Density	Desc	Transect	3.50	pedons	transects	2.00	2.00	1.70	1
0.93	0.29	0.96	0.28		2.70	2.80				

map units	# desc	# required	1st compon.	2nd compon.	3rd comp.	acreage	# tran. Points	# tran req.	Lab Data
94		3	1			102		30	0
101		3	1			474		30	
102		7	1			10479		60	
103		0	0			1334		30	
108		6	0.45	0.35		522		30	
120		6	0.25	0.2		25		30	
240		6	0.4	0.4		104		30	
247		3	1			183		30	
248		6	0.4	0.4		1173		30	
293		9	0.35	0.2	0.2	1		30	
358		9	0.35	0.25	0.2	1999		30	
350		9	0.3	0.2	0.2	374		30	
376		7	0.6	0.25		1868		30	
377		6	0.45	0.25		1024		30	
382		6	0.5	0.3		1570		30	
385		6	0.35	0.25		362		30	
393		6	0.4	0.4		483		30	
396		6	0.35	0.3		1383		30	
415	5	6	0.35	0.25		2473		40	
422	1	3	0.6			600		30	
469		9	0.3	0.25	0.15	1		30	
471		8	0.35	0.3		4257		40	
475	1	7	0.45	0.2		3775		40	
489		3	0.5			1		30	
496		3	0.6			1		30	
569	1	9	0.35	0.25	0.2	674		30	
701	2	9	0.35	0.25	0.2	2099		40	
705		9	0.3	0.2	0.2	325		30	
720	2	6	0.4	0.25		2270		40	
722	1	3	1			1		30	
723	6	6	0.4	0.35		1		30	
724	4	6	0.4	0.35		1		30	
725	1	6	0.4	0.35		1		30	
726		8	0.4	0.35		5122		40	
775	1	8	0.3	0.2		11798		60	
776		12	0.35	0.25	0.2	5836		40	
810	3	9	0.4	0.2	0.2	1		30	
816	1	6	0.6	0.2		1		30	
818	5	6	0.55	0.22		1		30	
826		6	0.65	0.3		638		30	
854	1	6	0.5	0.35		1		30	
876	6	6	0.4	0.4		1		30	
1720	1	3	0.45			1		30	
11A		6	1			7814		50	

39AB		3	1			171	30
3a53		6	0.5	0.5		1	30
40AB		3	1			390	30
413A		5	1			4450	40
413B		3	1			141	30
419A		4	1			1453	30
41A		4	1			3250	40
41AD		4	1			2478	40
41B		3	1			150	30
41jAB		3	1			874	30
420AD	2	6	0.55	0.25		1367	30
42A		4	1			3289	40
42AC		4	1			2826	40
42B		4	1			1167	30
43A		6	1			9533	50
43AC		3	1			301	30
43B		3	1			170	30
442BE		5	0.5			11541	60
45AB		8	0.5	0.5		4202	40
46AD		3	1			941	30
47AB		3	1			245	30
48A		3	1			884	30
490AD	2	9	0.3	0.3	0.25	1	30
50A		3	1			138	30
53A		8	0.6	0.3		5176	40
53AD		6	0.6	0.3		138	30
53B		7	0.6	0.3		1806	30
53C		6	0.6	0.3		554	30
56AB		4	1			2261	40
56C		3	1			92	30
57AC		3	1			285	30
59A		5	1			4349	40
59AC		3	1			968	30
59B		4	1			1128	30
5AB		4	1			1343	30
5u		4	1			1397	30
60AB		3	1			56	30
613A		3	1			145	30
613AD		3	1			564	30
613B		3	1			146	30
61A		3	1			557	30
61B		3	1			180	30
63AB		4	1			1738	30
67A		4	1			1372	30
67AD		3	1			763	30
67B		3	1			320	30
67C		3	1			247	30
68A		5	1			5758	40
68AD		3	1			664	30
68B		3	1			534	30
70AB		3	1			768	30
71A		4	1			1328	30
71AC		3	1			413	30
72A		3	1			316	30

72B		3	1	635	30
73AD		3	1	472	30
73B		3	1	647	30
76A		3	1	271	30
76B		3	1	115	30
80B		3	1	31	30
82A		3	1	1	30
82B		3	1	74	30
82C		3	1	135	30
84A		3	1	410	30
93A		3	1	159	30
93B		3	1	337	30
93C		3	1	156	30
93jAB		3	1	176	30
a1		4	1	1657	30
b1AB		3	1	449	30
b43AB		3	1	361	30
d1A		3	1	119	30
	46	823			5560

William Glenn: 158 descriptions
Field Handbook: about 80

Big Horn County

Attrib Doc	0.27			Spatial	0.60		Utility	0.48		
Pedon Score	0.12	Map Unit	0.59	Maps	Geo-Ref	3.00	Age	Format	Grade	Interp
Descr	Density	Descr	Transect	3.00	pedons	transects	2.00	2.00	1.70	1
0.93	0.13	0.99	0.20		3.00	3.00				

map units	# desc	# required	1st comp	2nd comp	3rd comp.	acreage	# tran. Points	# tran req.	Lab Data
39		13	0.4	0.25	0.1	10680		60	0
101		4	1			2145		40	
102		10	1			90416		60	
103		0	0			8000		50	
108		3	1			835		30	
112		4	1			1858		30	
120	1	8	0.3	0.3		6908	10	50	
310		6	0.5	0.5		600		30	
317	2	13	0.4	0.25	0.15	11096	20	60	
320	2	8	0.2	0.2		16064	20	60	
323	1	10	0.6	0.2		14160	10	60	
326		6	1			7300		50	
350		9	0.35	0.3	0.2	500		30	
377		6	0.45	0.25		1010		30	
378	2	8	0.4	0.35		8000	20	50	
385	2	8	0.4	0.35		7000	20	50	
387		6	0.4	0.2		1500		30	
388		15	0.3	0.25	0.2	20880		60	
402	1	4	0.5			2500	10	40	
403	1	5	0.4			11600	10	60	
414		3	1			55		30	
415		6	0.5	0.3		182		30	
417		9	0.4	0.25	0.15	1984		30	
426		9	0.55	0.2		7590		50	
477		8	0.5	0.25		5050		40	
489		6	0.45			20220		60	
490	1	8	0.4	0.35		3740	10	40	
495	2	6	0.5	0.3		1500	20	30	
505		6	0.3	0.2		230		30	
524		9	0.35	0.3	0.25	200		30	
526		5	0.6			7246		50	
601		10	0.4	0.4		13898		60	
611		6	0.4	0.35		675		30	
700		12	0.4	0.2	0.2	6440		50	
705	2	15	0.5	0.25		42624	20	60	
706		11	0.5	0.25		16492		60	
707		3	1			1		30	
720		8	0.4	0.3		4000		40	
776		9	0.4	0.2	0.2	1000		30	
777		9	0.35	0.25	0.2	1		30	
806	1	9	0.35	0.2		15620	10	60	
850	2	6	0.45	0.3		1950	20	30	
928	3	10	0.45	0.2		18000	30	60	
929		5	0.45			10220		60	
930		10	0.35	0.25	0.15	3130		40	
939		8	0.4	0.15		8000		50	

940		10	0.4	0.35		12000		60
11A		10	0.5	0.5		11614		60
11jA		8	0.5	0.5		2935		40
15AC	3	8	0.55	0.25		5176	30	40
16AC		4	1			2663		40
1A		4	1			2206		40
2A		5	1			4043		40
303A		10	0.5	0.5		8768		50
306A		8	0.5	0.5		2166		40
313A		6	0.5	0.5		229		30
315BD	4	16	0.3	0.25	0.15	26940	40	60
334AC		6	0.4	0.4		2168		40
341A		3	1			548		30
343AC	1	12	0.4	0.3	0.2	6034	10	50
351AC		4	1			2120		40
363AC	2	6	0.5	0.3		1104	20	30
367AC	1	9	0.6	0.35		10292	10	60
368A		8	0.4	0.4		2574		40
368AC	2	8	0.4	0.4		7940	20	50
368B		6	0.4	0.4		2432		40
368C		6	0.4	0.4		414		30
371A		6	0.5	0.3		1543		30
371AD	3	16	0.5	0.3		66170	30	60
371jA		6	0.5	0.3		1112		30
372CD	1	14	0.45	0.3		35376	10	60
373AB		6	0.6	0.3		743		30
374CE	1	23	0.4	0.2	0.15	78310	10	60
389CE	2	10	0.5	0.5		13870	20	60
390CD	1	19	0.4	0.2	0.2	40650	10	60
409A		8	0.5	0.5		4870		40
40AC		4	1			1473		30
413A		7	1			11265		60
413AC		4	1			2438		40
413jA		5	1			4042		40
41A		6	1			7225		50
41AC	1	6	1			8844	10	50
42A		4	1			3625		40
42AC	1	5	1			5632	10	40
42B		4	1			3855		40
42C		4	1			1043		30
43A		6	1			9318		50
43B		4	1			2857		40
442BC	1	7	0.45	0.35		2457	10	40
445DE	2	12	0.55	0.25		26532	20	60
446DE	1	14	0.45	0.3		36730	10	60
44sAB		5	1			4371		40
45AC		12	0.5	0.5		16526		60
467BD	2	12	0.4	0.2	0.15	8042	20	50
468AC	1	8	0.4	0.35		3232	10	40
46AC	1	6	1			8611	10	50
471CE		23	0.3	0.3	0.15	93064		60
472AD		13	0.5	0.4		20172		60
474AD	3	16	0.4	0.3	0.2	21460	30	60
47A		3	1			682		30
47AC	3	5	1			5974	30	40
48A		6	1			9998		50
493BD	2	12	0.4	0.2	0.15	9444	20	50

4A		4	1			2266		40
509A		8	0.5	0.5		6281		50
526C		7	1			11350		60
548A	3	6	1			7198	30	50
570AD	1	16	0.35	0.25	0.2	25492	10	60
572CE		7	0.5			29214		60
573BE		4	0.6			5140		40
59AC		4	1			2454		40
61A		5	1			5262		40
65AC		5	1			4353		40
66BC		4	1			1503		30
67AC		5	1			6335		50
71A		6	0.52	0.5		1879		30
71BC		6	0.5	0.5		1621		30
72A		3	1			289		30
72BC		4	1			3155		40
73A		4	1			1144		30
90A		9	0.3	0.3	0.3	1733		30
91A		4	1			1467		30
91AC		7	1			13530		60
91B		3	1			967		30
93A		4	1			1246		30
93AC		3	1			781		30
A41a		3	1			294		30
A41jA		3	1			676		30
a5A		4	1			2022		40
a68A		6	0.5	0.5		360		30
a68BC		6	0.5	0.5		159		30
a7A		5	1			5777		40
a7uA		6	1			7205		50
a9A		4	1			1104		30
b41AB		5	1			6341		50
b5		3	1			392		30
D43A		7	1			15345		60
mined land 1		0	0			3522		40
	66	1010				1276879	660	6030

typical pedons from handbook:
61
total pedons:
127

Appendix B. Notes about individual soil surveys.

Rock Springs [Pinedale & Kemmerer]

280 Highway 191 North
Rock Springs WY
82901

Phone # 307-352-0256
Fax # 307-352-0329

Manager: Stan McKee
e-mail:
rock_srpings_wymail@blm.gov

Contact: John MacDonald
Phone # 307-352-0238
e-mail: John_MacDonald@blm.gov
Cell # 307-350-8240

Area Administered

Correspondence

Date	Name	Format	Content
1/13/2003	John MacDonald	e-mail	initial contact/surveys
2/5/2003	Alex Stum	e-mail	proposed visit
2/6/2003	John MacDonald	e-mail	confirming date of visit
2/12/2003	Karen Rogers	e-mail	Pinedale Office soil data
2/21/2003	John MacDonald	visit to FO	notes on surveys from John MacDonald

Riley Ridge (BioWest)

Riley Ridge Project Phase I Soil Survey Submitted July 1, 1982

Prepared by: Dern and Polk Resource Consultants, Lander, Wyoming

Submitted by: Bio/West Inc., Logan, Utah

Submitted to:

American Quasar Petroleum Company, Ft. Worth, TX; Exxon company, USA, Midland, TX; Mobile Oil, Corp., Denver CO; Northwest Pipeline Corp, Salt Lake City, UT; Williams Exploration Company, Tulsa OK; and

U.S. Department of the Interior, Bureau of Land Management EISO
U.S. Department of the Interior, Minerals Management Service
U.S. Department of Agriculture, Forest Service

Location: Pinedale Resource Area: Southwest Sublette County, Wyoming. Located 10 miles Southwest of Big Piney near and North of La Barge.

Orthophotoquads: Maps where some part of the survey area is found

Primary Area: Meadow Canyon SW (Springman), Dear Hill, Pine Grove Ridge, Cretaceous Mountain, Chimney Butte, Lake Mountain, The Hogback

Outlying Areas: (Two proposed sweetening plants, 640 acres sites; proposed pipeline 50 miles x 100 feet; and a railroad spur.)

Opal (Railroad spur and pipeline)
Cow Creek Hollow (Railroad spur, pipeline, and sweetening plant)
Sugar Loaf NW (Sweetening plant)
Names Hill, Graham Reservoir, La Barge, Fort Hill SE, Fontenelle Reservoir SW (Pipeline)

Note: Cretaceous Mountain quad is missing. Names Hill, Deer Hill, and Opal are not orthophotoquads but topographic quads.

Survey Information:

It is an order 3 soil survey conducted as a start for an Environment Impact Statement (EIS). "The project area is defined as being the oil and gas units in which the producer participants will operate and any outside plant sites, pipelines, or other linear features." Low Btu gas deep in the Madison Formation is the target.

Acreage:

47,360 acres BLM
15,380 private land
3,840 acres state
66,500 acres total

This survey field work was completed in 22 days, September 5-27. Access to northern part was limited due to denied access of several ranches on private land. "Existing Soil Conservation Service soil surveys were used to obtain soils information for some of the private lands. Sufficient information was obtained from existing soil surveys to make tentative soil classifications and assist in writing map unit descriptions. For the remaining private land, where access was denied, soil delineations were inferred or extrapolated across similar landforms and landscapes."

Soil Correlation:

"During final report editing, the unnamed soils that were mapped within this project area were compared to soil series descriptions that were available from Wyoming and adjacent states. The local unnamed series were correlated to existing series when their characteristics fit within the range of characteristics of the existing series. A few soils that had characteristics slightly outside the range for an existing series were correlated to those series where it appeared that the use and management of the local soil is very similar to the existing series. Due to the limited amount of information that is available for many of these soils, this correlation should be regarded as being highly tentative."

The typical pedons are reference by a site # that is marked on the quads along with 1/4, 1/4 section

location.

Salt Wells Area

Submitted June 1979

Prepared by: Ellis G. Knox, Richard F. Wells

Submitted by: Soil and Land Use Technology, Inc.

in cooperation with Soil Conservation Service

Submitted to: Bureau of Land Management

Location: Central and Western area of Southern Sweetwater County (along Colorado/Utah border), part of Southwest Uinta County.

Mapping:

The location and extent of the soils are shown on 56 field sheets (separate from this report). These field sheets are quad-centered aerial photographs of approximately 1:24,000 map scales. Each sheet corresponds to a 7.5 minute quadrangle. Mapping was scheduled to be transferred by the BLM to 7.5 minute; 1:24,000 ortho-photo quadrangles as the ortho-photos become available. Because of variations in map scale, area measurements of the soils were not made on the field sheets.

Information:

- Order 3 soil survey
- 93 soil mapping units
- Correlation is considered to be informal
- Map unit legend
    - Legend includes map unit number, components of each association or complex
    - Some components are only great group or miscellaneous areas rather than soil series
- Pedon description
    - A specific pH is not given
    - Many individual pedons have no change in the fine earth fraction texture description throughout profile (from top horizon down). Example: Millpot Series A11, A12, C1ca, C2ca- Gravelly sandy loam, C3ca, C4- Sandy loam
    - 1/4 of 1/4 section
    - No elevation, climatic data, or pore description.
    - Some slope ranges are very extreme, example: Horsley Series 2-60% slopes
- Genetic key
    - Some soils are only classified to great group
- Technical guide

Tri-Territories

Soil survey 1980

	Acres	Date started	Finished Date	Intensity	Who did survey
SSA	100,000	June 9-13	August 25-29	Order 2	Dern and Polk Resource Consultants

23 potential soil series, 3 broadly defined units and 3 land types were mapped.
74 map units were used in the soil
survey
10 spot symbols used to designate important surface features less than 3 acres in size

A descriptive legend consisting of: (taken from letter written to Collin Voight by Gorge Otte)

1 soil survey legend
descriptions of the map
2 units
3 genetic key has been completed and needs to be typed

There are many revisions of the final soil survey, but we have at least 2 copies of the final version
No soil maps or photos included (probably on mylars)
Included is a figure of the quads involved in the survey.

Texaco Stagecoach Draw Project

Includes:

Texaco Els area
Pittman well
Simpson gulch SE Quad

Date started

11/1/1993

Soil transect data sheets:	Dates	Profile #
	11/1/1993	101- 151
	11/2/1993	Excluding 104-107
	11/3/1993	

No maps are included with the paper work but, there are map # references on every soil transect data sheet
On 2/24/00 there was correspondence from John McDonald with Ron from an NRCS office. I looked it up and
found there is a Ron Rackner in the Pinedale office as a soil scientist. Ron provided the So Sweetwater, WY soil survey (#750).
Included is a legend of "Tri-Territories Soil Survey Soil Survey Legend" August 29, 1980
Includes "Tri-Territories Soil Survey Description of the Map Units" August 29, 1980
Includes "Tri-Territories Soil Survey Genetic Key" August 29, 1980
Includes a paper entitled "Soils Notes" 11/5/93 (Looks like an update of problems with the survey)
Includes "Soil Transect Data Sheets" dated 11/1/93 all within Pittman well and Simpson gulch SE quadrants
Map unit descriptions, pages dated 11/93 (map unit descriptions)

Rock Creek

Soil Survey
About 83,200 acres

Color air photos:

includes survey boundaries
includes soil map unit numbers
includes Range & Township info
Photos are numbered

Geologic map of survey:

Tfg - *Gooseberry Mbr (Fowkes) conglomerate in white /s. matrix* **TFB** - *Bulldog hollow Mbr (Fowkes) tuff?* ***Tfs*** - *sillem Mbr (Fowkes) Conglomerate interbeds* **Tgr** - *Green River Fm.* **Tw** - *Wasatch Fm.* **Twt** - *Tunp Mbr-Wasatch Fm. Diamictic; boulders & blocks in red mudstone matrix; intertoungs* **TRE** - *Evanston & Hams Fork conglomerate* **KSJ** - *Sage Junction Fm.* **JSP** - *Stump S.S. & Pruess Red Beds* **JT** - *Twincreek Limestone (Calc. siltstone & Limestone (baseslopes))* **JTRN** - *Nugget Sandstone*

Mapping unit tables:

Why does it start at 105 E?
Originally done in '85 by Collins
Redone by C. Novack in '86
Symbols by numbers (100A, B, C..) with photo numbers for reference
Includes several versions of the legend
Includes 2 transect soil data sheets labeled "Rock Cr. Burn" (location unknown)

Complexes:

Also have photo numbers for reference
Are arranged in alphabetical order by units (MBE)
I don't understand why some are no to be used and others kept for use
Instructions to correlate to other units at the bottoms of pages
It's a form with the blanks filled in with data.
correlated photo numbers were not copied on some. (circled number at top of first page)
The legend for the complexes are a separate stack of papers entitled "Soil classification key to Cumberland allotment". Yellow tabs indicate corrections and revisions

Rock Creek (Yellow Folder):

Includes "Rock Creek Allotment Soil Survey Map Unit Descriptions"
Includes a map of the Rock Creek Soil Survey area
includes mapping unit composition
Includes a legend of map symbols and resulting mapping units
includes a handful of complex descriptions entitled, "Multitaxa Map Unit Description" (all of these are ink stamped "ADVANCE DATA SUBJECT TO CHANGE"

Rawlins

1300 North Third Rawlins WY 82301	Phone # 307-328-4200 Fax # 307-328-4224	Manager: Kurt Kotter e-mail: rawlins_wymail@blm.gov
Contact: Susan Foley	Phone # 307-328-4221	e-mail: Susan_Foley@blm.gov

Area Administered Albany, Carbon, Laramie counties. Encompasses 12.5 million acres, 3.5 million acres public land and 4.5 million mineral estate

Correspondence

Date	Name	Format	Content
1/21/2003	Susan Foley	e-mail	initial
2/18/2003	Alex Stum	e-mail	spring break visit
2/19/2003	Susan Foley	e-mail	March 10 visit is ok
3/12/2003	Susan Foley	e-mail	access files

Surveys of the Rawlins District

Survey Name	Who Did It	Date	Acreage
Platte and Overland	Texas Resource Consultants	Aug. 10, 1981	3,000,000
Overland	SaLUT	Dec. 1981	1,107,871
Sage Creek	SCS	1971	187,475
Seven Lakes	?	?	?
Shirley Basin & Mountain	BLM (& SCS?)	1984	1,000,000
Red Rim Area	SCS	1976	?
China Butte Lease	Mine Reclamation Consultants	?	16,800
Atlantic Rim Lease	Mine Reclamation Consultants	?	?
Crestone-Cherokee Lease	Mine Reclamation Consultants	?	13,760
Red Rim Lease	Mine Reclamation Consultants	?	12,800

Overland (TRC)

Soil Inventory of the Overland and Platte ES areas, Wyoming

Submitted August 10, 1981

Prepared by: Texas Resource Consultants, Lander WY; Belton TX

George Dern, Box 230 Squaw Creek Route, Lander WY 82520

Submitted to: Bureau of Land Management

In Co-operation With: Soil Conservation Service

Location:

Rawlins Resource Area: Carbon County

Problems:

Many of the transect and pedon description are referenced (geo-referenced) to a photo or field sheet, some are vaguely geo-referenced or not at all.

Survey Information:

It is an order 3 soil survey that covers about 3 million acres. The Texas Resource Consultants surveys are two discrete surveys, Platte and Overland. They both appear to be in Carbon County.

No information is contained in the survey that indicates how these surveys were done. It also gives no description summary of the survey area or location. The survey is a description of the soil mapping unit and a legend and pedon descriptions. We have no real way of knowing how reliable the survey is without extensive ground proofing. It is more of an Index than a reference. One could take the time and overlay the pedon description over a map. It appears that the Platte survey was actually in Natrona County.

Notes from contracting officers final decision:

March 12, 1982: A letter from Linda M. Waring-Wilson to George Dern in response to his claim for equitable adjustment. Linda responds to Mr. Derns 14 claims.

Cited are only portions relative to survey quality.

Claim #1: The BLM agrees that there were numerous trips to the field during the initial three party checking arrangement, however the only variance from standard procedures was increased checking due to contractor error. The initial three party checking procedure was agreed upon by all parties at the pre-work conference...Once changed, the process went more smoothly, but as more errors were found, more checking had to be done.

Claim #3: The contractor claims that a normal, systematically chronological flow of material did not occur, specifically the work to be performed by the Contractor's Cartographic unit. From all appearances the contractor was pushing to complete its mapping during the first summer, at the sacrifice of responding to quality control comments. It is mandatory that the contractor map the soil correctly before transfer of lines to mylar overlay can occur. I find that any disruption in the as planned activities of the contractor were the direct result of the contractor's failure to comply with the specifications and the claim is, therefore, denied.

Claim #5: The contractor has alleged that BLM required the contractor's personnel to perform a high percentage of field verification which should have been considered to be the kind of changes which would normally take place in the office. The contractor did not subscribe to the standard practice of using stereoscope to delineate map unit lines. Had this been utilized by the contractor, much of this problem would not have occurred. The BLM found a large number of soil mapping units that did not describe what was observed on the ground. This lack of quality work prompted closer review of the total field work being done.

Claim #6: The contractor is claiming a loss of production of 150.15 acres per field man day to confusion resulting from not knowing what to do with range sites. The contract states in Section F III B7: "Existing description of the range site (SCS) by local technical guides is to be provided by the BLM/SCS". During the course of the contract, the BLM had intended to provide the services of a GS-13, Range Conservationist for the field season of 1980, approximately two thirds of his time. As a result of manpower shortages BLM was unable to provide the range conservationist.

Claim #13: In the Rawlins area, the contractor claims additional delays due to match mapping in the area and spending time trying to match up with erroneous mapping previously done by other Government agencies (SCS). The BLM agrees that some of the match mapping proved difficult because the contractor had to match up to some bad maps. This is however an inherent problem in soil surveys... In this particular case, the contractor feels that the delay was caused by bad mapping on the part of the Government, as well as that done by other contractors. The BLM feels that this is a task in which there are most always problems and they should have been expected on the part of the contractor when they proposed the job. This case however, has more than the "normal matching problems,...

Of the above quality issues mentioned in the letter it is not clear if they were problems encountered during the survey and corrected or whether they exist in the completed survey. For example #5 mentions that "BLM found large number of soil mapping units that did not describe what was observed on the ground." This resulted in closer reviews, but did they fix them, are there other map units that are inaccurate as all of them could not be reviewed?

Susan Foley mentioned that it was poorly digitized. The rumor is that it was digitized by several people, and was used as training. This becomes evident with digital overlays that don't match up with features on topo or orthophotoquads. For example a mountain or a draw is shown on the topo but isn't represented in the soil map or it is offset (doesn't match up). They are very inconsistent and have too many forced identities (closest fit).

Contents of Survey

Identification legend

Overland survey: 211 map units

Platte survey: 144 map units

Map Unit Descriptions

Soil Series: typical pedon description with range of characteristics which are compared to official soil series.

Explanation of Range In Characteristics Table

Status of Soil Series

Overland (SaLUT)

Submitted December 1981

Prepared by: Soil and Land Use Technology, Inc.

Richard F. Wells, Thomas K. Divney, Ellis G. Knox, Robert W. Puls

In cooperation with Soil Conservation Service

Submitted to: Bureau of Land Management

Location:

The survey is composed of two discrete halves centered along I-80. ***North:*** The Northern half's Southern border runs 40 miles along I-80 and its northern border nearly parallel 20 miles to the North. It is exclusive to Eastern Sweetwater county. The area is entirely within the Great Divide Basin, therefore internally drained. ***South:*** The Southern half runs 60 miles against Colorado Wyoming border; the Northern border is irregular, 12-27 miles to the North. It covers Southeastern Sweetwater county and Southwestern Carbon county. The area drains into the Little Snake River, a tributary to the Yampa River.

Mapping:

The location and extent of the soils are shown on the ortho-photo overlays (separate from this report, I have not seen them). Each sheet corresponds to a 7.5 minute quadrangle; the is 1:24,000.

Notes:

The survey area covers 1,107,870.6 acres. It was mapped during the 1979 and1980 field seasons. Survey is made up of 182 soil mapping units. The typical pedon may occur in a map unit which is located in either or both of the Overland and Green River areas. There are 99 typical pedon descriptions.

Contents of Survey: It is a two-part volume

Survey Area: description of the location and nature of the survey, general map of soils

Map Unit Legend: % of composition of soil series within the map unit is given

Table of Acreage: acreage of each map unit

Map Unit Descriptions

Photos of major soils

Use and Management of Soils: table of engineering properties, table of physical and chemical properties, table of water features and a table of soil features

Genesis and Classifications of Soils: table of taxonomic classifications and a table of Genetic relationships of soils

Taxonomic Unit Descriptions: typical pedon descriptions

Range Site Descriptions

Sage Creek Watershed

Prepared by: Soil Conservation Service
Appears to have been done around
1972

by: James R. Stephens, Jr.

Havlor B. Ravenholt: assisted in the field work, Arvad J. Cline and Clarence J. Fowkes: assisted in field correlation. All are soil scientists with the SCS.

In Co-operation With: Bureau of Land Management

Location: Rawlins Resource Area: Carbon County

South of Rawlins, East and North East of Saratoga. The high West boundary is the Continental Divide, the East boundary is the North Platte. The North and south bounds are formed by high rimrock ledge in most places.

Survey Information:

survey covers 187,475 acres

Seven Lakes

No information on who did it or when it was done
Located North of the SaLUT Overland survey in NE Sweetwater County, NW Carbon County and SW Freemont County. The survey area extends North to the Sweetwater River, including the Green Mountains. They are geo-referenced by relative location, such as "The soils of this complex occur on nearly level to sloping high terraces. Many of these terraces occur north of Bairoil, on the south side of Whiskey Peak and Breen Mountain." Taken from map unit 202.

It nothing more than a Map Unit Legend and Map Unit description. The Soil are uncorrelated classified down to taxonomic sub-group and some family modifiers. There are 41 map units divided into four climate classes: numbers 101-102= 15-19 inches precip., numbers 200-216= 10-14 inches precip., numbers 301-322= 7-9 inches precip., number 401 is rock outcrop.

Shirley Basin and Mountain

BY: The survey appears to have been done by SCS and BLM
Richard Larson and Steve Howell of the BLM

Survey Notes:
What I have of these surveys (primarily Shirley Basin) appears to be a survey that was never completed. It encompasses approximately 916,000 acres and perhaps another 139,600 acres of what is described as Checkerboard Shirley Basin. The Shirley Mountain survey is encompassed by the Shirley Basin survey. It is located just Southwest of the Shirley Basin survey's center.

Problem:
Many of the 232 Forms are classified by soil series and not taxonomically.

Contents of Surveys
Shirley Mnt. 1/27/1981
Mapping Unit Legend: % of composition, brief location of components in landscape
Map Unit Descriptions:
Shirley Basin 1984
Map of quads: approximate area of survey is sketched and shaded over quads.
Mapping Unit Legend
Alphabetic Series Listing: series and the soil classification
Correlation Box Sample Index: Map Unit sym., stop # which correlates to sample # from lab, tax. Unit
Lab Results: sample No. refers to stop No. and which is correlated on the Correlation Box Sample Index to the map unit symbol and taxonomic unit, the 232's have both the stop No. and map unit symbol. The test include % Sand, Silt, Clay, textural class, vfs%, soil fraction, %gravel, % water at saturation, pH paste, EC, Soluble Cations: Ca, Mg, Na, K, SAR, OM%, OC% CaCO3%, Gypsum %.

232 Forms and some transect sheets: referenced with Map Unit symbol
Soil Classification Table: Order/Subgroup/Family/Series
Map Unit Legend: hand written, %composition of components, taxonomic name class, landform
Alphabetic List of Components
Taxonomic Unit List
Soil Series List: list the number of descriptions for each series and the number still needed
Map Unit Legend
Rough Notes: appear to be field note on the landscape

Lander

1335 Main (PO Box 589)
Lander WY 82520-0589

Phone # 307-332-8400
Fax # 307-332-8447

Manager: Jack Kelly
e-mail: lander_wymail@blm.gov

Contact: Greg Bautz
Phone # 307-332-8437
e-mail: Greg_Bautz@blm.gov

Area Administered

Correspondence

Date	Name	Format	Content
1/13/2003	Greg Bautz	e-mail	initial contact
2/27/2003	Alex Stum	e-mail	spring Break visit
2/28/2003	Greg Bautz	e-mail	confirming visit
3/12/2003	Greg Bautz	e-mail	7100 soil resource manage.
3/12/2003	Alex Stum	e-mail	reply
3/13/2003	Greg Bautz	e-mail	Fax
3/17/2003	Janis Boettinger	e-mail	verify fax

Newcastle

Phone # 307-746-6600 Fax # 307-746-6639	Manager: Bill Hill e-mail: newcastle_wymail@blm.gov
Phone # 307-746-6600	e-mail: James_Bashor@blm.gov
Phone # 307-746-6620 Crook, Niobrara, Weston counties	e-mail: Rod_Randall@blm.gov

Format	Content
e-mail	initial contact
e-mail	contact info
phone call	Eldon Allison Maps

Appendix C. Other notes (Divide Ridge, meetings, etc.)

Divide Resource Area Notes

December 22, 2003, Alex Stum
I found a hand written notes on yellow legal pad paper. I know that it was written in 1985 or earlier. It was found in one of the drawers from the filing cabinets from Rawlins in a folder labeled "Needs Concerns Contract Soil Surveys." I suspect that it was probably written by Dick Larsen.

Divide Resource Area Soil Survey
Needs to Meet National Cooperative
Soil Survey (NCSS) Standards

Soil Surveys in the Divide Resource Area have been conducted under tow BLM contracts (SaLUT and TRC), SCS and BLM. The area was mapped under the direction of four soil survey party leaders. There was little correlation, coordination and cooperation among these soil survey party leaders. AS a result, the Divide soil survey is made up of several individual Order 3 surveys (See Map #1). The National Soil Survey Handbook recommends one party leader per soil survey area to ensure consistency of mapping. There was also little correlation and coordination exhibited within the soil survey parties under BLM contracts. Consistency of mapping is a major concern. BLM and SCS soil scientists did make changes in the mapping of BLM contracts through range site-soil correlation problems and field checking. This provided some consistency in mapping. A useable soil survey was provided through these changes but there are still problems with meeting NCSS standards. The main problem with not meeting standards is the lack of documentation, as well as suspect documentation collected by soil scientist under BLM contracts.

One other area of concern is the lack of understanding of the detail of information obtainable from an Order 3 soil survey. An Order 3 survey is to be used for general planning purposes. In the Divide Resource Area, these soil surveys have been used on a more site-specific basis than for what the surveys were designed. This had led to confusion among all soil survey parties as to what type of soil survey was really needed. Users of the Order 3 soil surveys will be educated on how to use the survey. Because of the broad land uses in the West, an order 3 survey has been found to be adequate to meet most needs. Once the user understands the limitations of an Order 3 survey and the soil mapper can be provided to facilitate the user's general needs.

There may be an excessive amount of soil map units in the Divide Resource Area. There are approximately 370 soil map units, many of which appear to be very similar in composition and/or taxonomically. Some of these units may be combined, reducing the number of map units. As stated in the National Soils Handbook "unnecessary separations are time consuming to delineate consistently, and they make the survey more difficult to use."

Some soil map units were combined with other map units that should have been separated. Some soil map units used by one survey party could have been mapped by another party but weren't. This is because not enough acreage was found by one survey party for use. As a result these low acreage units were lumped with other map units of more extensive acreage; even though there was enough acreage of the unit in the Divide

Resource area as a whole. This has lead to mapping inaccuracies and inconsistencies. Also map units that have been dropped by the contracts are still on soil survey map. There is no list of these types of units which explains to what these map units were correlated. This leads to difficulty in using the survey.

Approximately 76% of SaLUT's and 64% of TRC's map units were used in common with each other or with SCS and BLM mapping. It has not been determined how consistent these map units have been mapped among the various soil survey parties. It is known that some map units established by SCS were grossly misused.

Because of the above three situations, a viable soil survey legend must be developed for the Divide Resource area. Credibility and consistency of each map unit must be established. This will be done through air photo interpretation and field examinations. Several major delineations of each map unit will be determined by the extent of the map unit and the amount of problems encountered as delineations are checked. Map units may be combined, names may be changed or new map units may be designed. When enough observations establish the credibility of a map unit, necessary documentation will be collected to meet NCSS standards.

Several series have been mapped that may be proposed as new series. Some of these series have been observed enough by both SCS and BLM soil scientists that they can be submitted for proposal if enough documentation exists. Because some of the BLM contract work is suspect, other "new" series will need more verification before they are proposed. It has been suggested by Phil Derr, SCS state Soil Correlator, that only those new series that are thought to be extensive should be submitted for proposal. A list of series to be proposed will be developed by the Divide Resource Area Soil Scientist and the SCS Sol Survey Party Leader in Carbon and Sweetwater Counties.

The SCS soil survey party leader for Carbon County has recently delineated areas in Carbon County has recently delineated areas in Carbon County that he will rework to meet standards. These areas are comprised of large areas of private land. These areas are depicted on Map #2 and overlap areas mapped under BLM contracts. Only those areas not delineated to be reworked by the SCS soil survey party leader will be brought up to standards by the BLM. Cooperation and Coordination is still a necessity between the two agencies. Both agencies will be using the same soil map unit legend to meet standards. By cooperating, consistency in mapping will be ensured. The same cooperation and coordination is needed between the BLM and SCS soil survey party leader for Sweetwater County for the same reasons.

There are several areas in the Divide Resource Area that will need more intensive examination. These areas are on Map #3. The green are is the 7-Lakes EIS area and will be mapped to a Order 3. The red areas are areas mapped under BLM contract that have had no quality control. The blue area is Sage Creek soil survey. Major problems with soil-range site correlation have been identified here. These areas will be reworked after a viable map unit legend is developed from the other areas of lesser problems. Since some of these problem areas may need remapping, a viable map unit legend will be beneficial to map these areas more quickly.

Soil maps and overlays have delineations drawn on them with pencil and felt tip pens. Amore uniform and legible method of inking field maps and overlays is needed. The preferred method is the use of rapidograph pens using different size pens to delineate different features on the soil maps. These guidelines are discussed in the SCS publication

"National Map Symbol Handbook" Title 170, Part 601. It would be too time consuming to reink many of the soil field sheets. Only those field sheets that are torn, folded or not legible will be reinked on new field sheets with rapidograph pens. All overlays will be retransferred using rapidograph pens when the field maps are finalized.

AS this proposed plan progresses, field reviews will be scheduled with SCS Wyoming State Office Staff to ensure a quality product. Correlation will also be done with the Medicine Bow Resource Area mapping. Field work will start during the fiscal year 1985. Completion will depend on the number of people available to work on this project and the amount and degree of difficulty of the problems encountered. Approximately 3 to 5 years is anticipated.

December 23, 2003, Alex Stum
These notes were also written on yellow legal paper pad. It was found in one of the drawers from the filing cabinets from Rawlins in a folder labeled "Needs Concerns Contract Soil Surveys." I suspect that it too was written by Dick Larsen. Both have the same hand writing.

Summaries

TRC

- 27 Typifying pedons in report are from outside TRC survey area.
- 67 Map Unit descriptions are copied from other survey areas (SCS, SaLUT).
- 45% of total series do not have enough documentation. This % will increase due to descriptions not available for all map units the series occurs in and descriptions that don't fit the official series descriptions. (Spot-checking has indicated these problems, 31 out of 44 checked needs better documentation).
- 76% of TRC map units lack transects (none exist)
    - 3 map units out of the 24% that have transects reflect map unit components
    - 99% of the map units need transect documentation

SaLUT

- 56% of soil series lack documentation. This % will increase due to descriptions not available for all map units in which the series occurs, and descriptions that don't fit the official series description. (Spot-checking has indicated this problem, 5 out of 7 needs better documentation).
- 60% of soil map units have transects. 9% of the 60% don't reflect map unit composition as shown in the report. 70% of the map units require transect documentation.

(more notes)

- Some documentation gathered not representative of unit gathered in, i.e. Shellcreek. BLM & SCS tried to combine all available documentation to propose series. But, most complete and representative 232 were written by TRC. Went out to find the soil in the delineation gathered but couldn't find. Boggy meadow.

Transect check showed over 75% of transect data does not reflect map unit description.

- Many 232 transect descriptions difficult to read, poor copies, not complete enough to determine if fits series or not.
- Conversation with WE of TRC indicated much time spent looking for documentation for a soil in a M.U. it was supposed to be in. Also several transects run until found one that showed what they wanted to show (Corral Canyon area MU. 1475?). Bull Springs: checked unit where representative pedon collected. Couldn't find this soil when checked photo. Contract wouldn't chose unit or get another typical pedon of this unit because is where they say they gathered typical pedon.
- Some map units on maps where once mapped but later dropped. These units still on maps but not in reports, 711 an example.
- Field sheets don't match between contract areas. SaLUT field sheet don't match with each other.
- Most changes made to best satisfy range sites, not necessarily soils.
- When checked sheets, never saw what representative areas of map units were before checked. Nothing typical to compare map units too.
- SCS previous work was preliminary. Was divided to use this for EIS, contract work was supposed to be final.
- When checked if range sites and landscape looked to fit soil map unit, soils not checked. Soil could still be mapped wrong in these areas
- SCS Carbon Co. party leader says some typifying pedons in contract report are his. TRC 27 typifying pedons outside survey area, 67 MU descriptions copied form other surveys (SCS, SaLUT).
- Had meeting on SaLUT documentation. Many series and M.U. found deficient. No more documentation gathered to meet requirement. BLM state office signed off on SaLUT work, even though didn't meet NCSS or BLM needs.
- Documentation based on mapping. If mapping has to be checked for accuracy so does documentation, which wasn't done. Most documentation doesn't reflect what was mapped.
- Probably take longer or as long to check documentation than would to remap and/or redocument. And fix needs determined by document check. Need to check 391 M.U. and 242 series form TRC and SaLUT.
- Checked field sheets with contractor. When checked and contractor made suggested changes sheets were signed off on. Once sheet was signed off on no more changes were made. Hard to determine if new units should be set up or not if had to sign off in this manner. A unique delineation found on one field sheet may not occur in rest of survey area. Don't know this until checked rest of survey area. If more _________? Can't set up new unit because signed off on other field sheets it was ________? On. Unit lumped with something close.
- Surveys treated as 4 different surveys but were combined for EIS. 4 different legends

A. No coordination between contracts, SCS, BLM (Files show numerous letters etc. from SCS and contracts, little from BLM).

B. Five separate reports, different formats, none on BLM mapping.
C. Units found by one contract not used by the other because of acreage deficiency in individual contract areas. (497 and 498 occurred in TRC area but not used due to low acreage.) Excessive lumping when a more suitable unit existed. By using these types of units required more work by contract: i.e. more soil descriptions, transect, map unit and series write-ups in report.
D. Contract areas not uniform, some areas surrounded by other contract area, SCS or BLM. Duplicate of work, M.U. and series write ups documentation.
E. Some units set up by one contract mapped wrong by other contract, BLM or SCS because rangesite composition etc. when final report submitted was changed. Mainly SaLUT when SaLUT, SCS, BLM all mapping at same time.
F. Changing procedures different between SaLUT and TRC CP's close field checking.

- Probably have to rewrite documentation to make more legible if possible.

December 24, 2003
A photocopy of a hand written paper titled "Improving Cost-Effectiveness and Output In the Rawlins District Soil Survey program." I found it in a folder titled "Correspondence BLM." I suspect that it was written by Steve Howell (Medicine Bow R.A. soil scientist), it is also possible Floyd Ewing (Medicine Bow R.A. area manager) wrote it but the handwriting seems to be that of Steve Howell. The most recent reference is 1980.

As Pomerening stated in his analysis of the BLM soil survey program in 1980, the program "is suffering the pangs of a new birth and a rapid growth." Specifically, the pangs of a new birth originate not only from the 3rd order mapping of rangelands but from soil scientists attempting to adapt to a new system of soil naming and mapping established in 1975 (Soil Taxonomy, USDA, SCS). 3rd order soil mapping of rangeland was unknown until the early 1970's, and the accelerated level we know today as SVIM was not field tested until 1978 (Pomerening, 1980). Soil Taxonomy as we know today is still in its infancy and to many soil scientists, trained n earlier systems, it is neither used properly or consistently in many instances. It should not be surprising with these radical changes in soil mapping direction and in soil taxonomy that problems have developed in BLM 3rd order contract soil surveys.

Despite the problems facing soil scientists, which were mentioned in the previous paragraph, a method of soil and vegetation mapping which meets BLM's needs has been field tested and established for use in Utah (see appendix 1). This system is called the Ecological Site System of Soil Mapping. The Ecological site Method uses the concept of interdisciplinary mapping to improve not only the quality of mapping but also improves cost-effectiveness and output. The need for this new system of mapping was evident in Utah as problems consistently occurred in 3rd order mapping. The major problems encountered are listed below, and some if not all of the problems are also evident herein the Rawlins District:

1. Independent disciplines (soil scientist and range conservationist) working independently on a soil-vegetation survey (SVIM) con only

produce minimally correlated products. The quality of each individual product, I.e. the soils map or the range map, may be of high quality but the usefulness of those products to the planner is severely limited by duplication of information and effort, by excess bulk, and by misrepresentation of the natural system. There is no question that soils and vegetation must be correlated for a successful and useful soil survey, the ability to achieve this correlation is made…

2. Mapping of soils and vegetation as separate mapping teams doubles vehicle use, travel time, and drastically increases the need for time consuming correlation problem field checks. Mapping as separate disciplines reduces cost-effectiveness and output.
3. We not only invite mistakes in mapping when we allow soils and vegetation mappers to work separately but we also are not utilizing the expertise of either discipline to its optimum. It has long been known that vegetation is a reflection of soils and vise-versa, to ignore established soils-vegetation correlation by mapping as separate disciplines increases the need for CP's (correlation problems).
4. Cooperation and correlation is not only essential between range and soils personnel but is also essential between BLM soil scientist and contract soil scientist. An ideal survey situation is BLM soil scientist mapping along side the contract soil scientist, implementing quality control on a day-to-day basis as mapping units are developed. Working together not only familiarizes BLM soil scientist with soils in the area and mapping procedures but helps to eliminate checking of CP's.
5. Soil map checking by BLM soil scientist after contractor field work is complete is not cost-effective for the following reasons:
    a. BLM personnel and contractor personnel must spend significant field time re-mapping or re-investigating previously mapped areas. If BLM and contractor work together as mapping is done, this extra travel time, field time, etc. can be eliminated.
    b. BLM soil scientist expertise and knowledge of the area is essential in setting up survey legends and map units and time should be spent assisting contractor throughout the survey not after mapping is complete.
    c. Checking alienates BLM soil scientists from contractor soil scientists resulting not only in reduced communication but also in unproductive efforts on both sides to maintain professional integrity. Contractor dissatisfaction may result in poorer survey quality and may lead to BLM soil scientist developing a role as adversary rather than as a team member in the survey effort.

No method of soil survey is going to eliminate all correlation problems. However, the Ecological Site Method will eliminate most problems, which are caused by a lack of communication and correlation among mappers. A review of contract surveys in the

Rawlings District illustrates a majority of problems resulting from the lack of communication and correlation between soils and range mappers and between BLM soil scientist and contract mappers. These types of problems should be reduced significantly by establishing the Ecological Site Mapping Procedure in this district.

The ecological site method of mapping outlined in Appendix 1 is based on several assumptions; the main ones pertaining to the Rawlins District are listed below:

1. The objective of a soil survey to not merely gather facts, the objective is to gather relevant facts, which affect our use and management of an area. Checking of mp units by BLM soil scientist who have not mapped the area may not only bias the relevant facts concerning map units and soils over the whole survey area but it also interjects differences of opinion on technical points long after decisions on these points should have been made.
2. The majority of contractor, SCS, and BLM soil scientists are not experienced in proper management and use of a 3rd order rangeland survey, since a format for those surveys was not developed until 1980. BLM must realize their need to educate, assist, and cooperate with all personnel involved in a 3rd order survey for success.
3. A soil survey must be a team-oriented effort, since the quality of the final product is a reflection of several disciplines and many individuals combined efforts.
4. Correlation problems can be significantly reduced using the ecological site method but never completely eliminated since individuals will have differences of opinion in interpretation of the natural system with all survey methods. Cooperation and communication reduces most of these differences over time however.

My comments reflect observations while here in Rawlins and observations from Utah where the Ecological Site Method of Mapping was developed over 4 years of field-testing various methods of 3rd order rangeland mapping. It is not the answer to all survey problems but it is a proven logical method of obtaining a high quality survey product applying the most cost-effective methods established to date.

December 29, 2003
The following is from Instruction Memorandum No. WY-84-98, dated November 29, 1983, to District Managers, from Deputy State Director, Land and Renewable Resources (E.W. Spencer).

Subject: Evaluation of Soil Survey Activities

Field reviews held in FY 83 have identified the following shortfalls to our soil survey activities.

NCSS Standards
The Bureau is committed to conduct soil surveys in accordance with NCSS standards. This includes preparation of a memorandum of understanding (work plan) for each specific survey area (National soil Handbook 601.02-1). This is to the advantage of the

Bureau, if for no other reason than to formally document the purpose of the survey, intensity of field procedures, interpretation and display needs, and quality control measures and responsibilities. At present, three of the four Districts are making soil surveys without an MOU in effect. Because use there are unresolved issues between the BLM and the SCS in Wyoming regarding field procedures, documentation requirements, and publication responsibilities, the MOU takes on added significance.

Pedon Classification

Each pedon description should be classified to the family level and recorded on Form 232 along with the profile description.

Several of the pedon descriptions examined carried a series name but no family level classification. This practice gives the appearance that soil series are used to determine family classification rather than the converse, and the series are being projected beyond their range in characteristics rather than taking the time to propose a new series.

Laboratory Data

A laboratory plan should be developed to include a brief discussion of anticipated laboratory data needs, the facility or facilities to be used, general sampling procedures to be followed, etc. Lab analyses will be necessary to resolve classification questions. In addition, there may be certain soils for which more detailed laboratory characterization is appropriate.

Correlation Samples

Correlation (box) samples should be collected as part of the survey effort. The samples not only provide valuable documentation for the correlations process, but they are useful to illustrate soil variability to those in other disciplines. One sample should be collected to represent each typical pedon. Secure storage is essential for the collected samples' long-term storage needs.

Lander Visit Notes – Alex Stum, Nephi Cole, Jedd Bodily

Notes from our visit with Greg Bautz in Lander, March 11, 2003
The NRCS surveys: Freemont county East area and Dubois and Riverton soil surveys, are good. He has found them to match with what he has observed out in the field.

The Lander NRCS survey is not so good. The survey map units are vague and much too broad. This is especially the case for BLM lands and sloped terrain. Drainages and vegetation are too intermingled. An example was map unit 42, which covered a large area of terrain including both aspens and sagebrush. Towards South Pass he had problems with range sites matching up. The survey is better on private and irrigated lands.

128,000 acres of northern Sweetwater County are part of the Lander Field Office and have not been surveyed. In a letter from Richard Larsen to state director, February 5, 1988, he also mentioned this saying, "Approximately 128,000 acres in Northern Sweetwater County have not been mapped at Order 4. This is the only acreage in the Lander Resource Area that has not been mapped at the Order 3 level. This area has a utility corridor going through it, potential for habitat improvement projects (especially near Pickett Lake), and potential for oil and gas development. However, there have been no requests for soils information or projects developed in this area.

Good suggestions for all:

More in the BLM should learn to better use soil surveys and understand the information to use topsoil definitions. More input from BLM is needed. BLM soil and range technicians should be part of teams doing the soil survey. "BLM should have an input in map unit design.

Badlands to one could be used for other purposes by another and will need info for putting roads in etc.

NRCS and BLM need to communicate and define what BLM's specific needs are.

Rawlins Visit Notes – Alex Stum, Nephi Cole, Alex Stum

Notes taken from our visit with Susan Foley in Rawlins, March 10, 2003
There exist four major soil surveys and several smaller ones.
Susan referred mainly to four surveys: Seven Lakes (SCS), Shirley Basin (BLM), TRC (namely the Overland), and SaLUT (SCS).

She found the surveys to be unreliable, with random textures that don't match up while vegetation does. She has found texture descriptions of sandy and found soil to have 50% silt. The inconsistency in surveys makes them unreliable. Some map units have had an identity forced upon them that is the closet fit but isn't representative the soil; a new series needs to be made (maybe another series has been established since survey was conducted that would fit). Some polygons don't match up on survey boundaries; so edge matching is a problem. As a single individual she does not have the time to verify every survey and ground proof. There are also missing quads.

They useful for general planning and broad bush planning but not useful for planning things like building roads or fences.

She would like soil maps that could be called up at any scale with on overlay of restrictions for example road construction or can it be burned. They need ground truthing and correlation. Mainly she would like to have a product that was fully digitized, that necessarily wasn't published but useable by anyone who needed it. From there develop a product with restrictions and limitations. A more user friendly product.

Survey notes:
TRC was poorly digitized. The rumor is that it was digitized by several people, and was used as training. This becomes evident with digital overlays that don't match up with features on topo or orthophotoquads. For example a mountain or a draw is shown on the topo but isn't represented in the soil map or it is offset (doesn't match up). They are very inconsistent and have too many forced identities (closest fit).

SaLUT has similar problems to that of TRC with consistency and identities.

Sage Creek (SCS) soil data has been reliable but range descriptions of specific vegetation is poor. It is also fairly old and becoming out of date and doesn't meet all her needs.

Shirley Basin seems to have problems with map units and the correlation but hasn't had too much experience using this survey.

Seven Lakes is an order 4 survey and is too broad as such so it is unusable.

There are some smaller surveys that Susan has never used.
Mine Reclamation Consultants Inc.:

- China Butte Lease -- 26.25 square miles
- Atlantic Rim Lease -- quarter mile to one mile wide following Atlantic Rim
- Crestone-Cherokee Lease 21.5 square miles
- Red Rim Lease 20 square miles

Red Rim Area (SCS) in cooperation with BLM 1976

Notes made by Nephi Cole:
41107D22
Two file cabinets exist with correspondence related to, and 232's and transects from various soil surveys. This encompasses 1 to 3 232's per map unit in most instances. Letters where present from SCS officials to BLM officials expressing problems in map unit descriptions. Notes from field reviews are present.

Documents exist concerning some of the surveys that indicate that private surveys were not done to the satisfaction of BLM. Order 3 quality was no met.

Large amounts of data are here and should be moved to location of a new survey if it is begun in this area.

Get Carbon county, Sweetwater, Mr Sids from Randy.

Richard Larsen
In a letter from Richard Larsen to state director, February 5, 1988, he pointed out some soil survey needs:

"Although these survey areas are mapped, there is still a lot of work necessary to gather sufficient documentation to meet NCSS standards. The work varies from survey to survey, but consists mainly of the following:
Documentation was originally gathered for the Carbon County and Eastern Sweetwater County soil survey. This survey area will be divided into at least three soil survey areas. The profile descriptions are not evenly distributed within each survey area and insufficient numbers of descriptions were collected for three survey areas. Data needs to be collected to verify percent composition for some of the map units. Several new series need to be documented and proposed. Series within one map unit were correlated with two or more range sites. Edge matching between surveys is limited. Soil interpretation tables need to be developed."

Worland Visit Notes – Alex Stum, Nephi Cole, Jedd Bodily

Notes from our visit with Steve Kiracofe in Worland, April 18,2003.
Also included is information from a transmittal sent by Steve Kiracofe on January 15, 2002, via e-mail. The document was titled usu_response.doc.
Prepared by Alex Stum, May 10, 2003.

The Bighorn River Basin is made up of four counties: Washakie, Big Horn, Hot Springs, and Park. Each county is also their own Soil Survey Area (SSA) excluding NSF land and National Park land: Washakie SSA WY043, Big Horn SSA WY603, Hot Springs WY617, Park WY629. Washakie County is digitized and mylars exist for the other three counties.

In the late 70's to early 80's, the BLM and the SCS were coordinating together to complete soil surveys in this area. Somewhere in this process a falling out between the two agencies halted further progress on these surveys. The original data for this work is lost. It was housed at the NRCS Powell office, Steve said that according to Tom Gusffason (with the NRCS) it is gone. The Worland BLM office does have the Original Soil Survey Field Handbook for Park and Big Horn Counties with:

A. Soil Survey Field Legend
B. Classification of Soil Series
C. Pedon descriptions
D. Soil map unit descriptions

The Worland BLM office also has aerial photo graphs with original map units and pedons.

The Washakie County survey did reach completion and was published in 1983. It has been digitized and can be viewed in:

A. ArcView
B. Soil Survey Geographic Data Base (SSURGO)
C. NRCS Soil Data Viewer

The SCS requested that more pedon descriptions and transects be run in Hot Springs, Park and Big Horn Counties. The BLM contracted with William Glenn in 1990 to complete this. His work is very detailed and appears to be accurate. Steve also finds his work to be very well done. For all the map units, that were created by the SCS/BLM work, William ran transects and described pedons. For some map units he recommended different percentage of compositions. His work includes the following:

D. Sheet with component composition from Original Soil Survey Field Handbook and the composition that he observed with notes.
E. Pedon descriptions (SCS-232)
F. Soil series comparison sheet
G. Transect data sheet

Much of Hot Springs County was survey by Soil and Land Use Technology (SaLUT) in 1978-1979. The survey is Grass Creek and also includes parts of Southeastern Park County. It, according to Steve, is pretty good and he has found fairly reliable. It is an order III.

In 1981-82, BLM personnel added additional map unit to expand coverage. They include map unit descriptions. These descriptions include range descriptions and composition of the different soil types that compose it. The soil series description is vague only giving general description--no detailed pedon description. There appears to be only 7 additional map units added with no legend. According to the Grass Creek survey by SaLUT, 31 field sheets were provided separately from the report. These field sheets were aerial photographs of approximately 24:000 map scale and were scheduled to be transferred by BLM to 7.5 minute, 1:24,000 ortho-photo quadrangles.
Soil maps on mylar orthophotoquads and topographic maps. Nothing available in digital format.

Identification Legend – Hot Springs County - SSA 617 dated 10/81
Classification Legend - Hot Springs County - SSA 617 (no date)
Generic Key - Hot Springs County - SSA 617 dated 3/82
Soil Survey Legend - Hot Springs County - SSA 617 dated 1/82
Identification Legend – Hot Springs County - SSA 617 dated 12/80

Soil Descriptions, Hot Springs County SSA-617
Prepared by William Glenn under contract to BLM in 1990
Total Descriptions – 188
- SCS-232 descriptions
- Soil Series Comparison Sheets
- Soil Transect Data Sheets

Field Office Tech Guide (FOTG) for Hot Springs County produced by NRCS dated 8/13/97. This data is contained in the Electronic Field Office Tech Guide (EFOTG) that is available on line.

In January of 2002 limited digitizing of 13 quads was started. Data has not yet been attributed and no electronic data base is available.

Original field sheets and SCS-232 are not available.

Big Horn County
Original Soil Survey Field Handbook with the following documentation:
- Soil Survey Field Legend – Big Horn County SSA-603 dated 1/85
- Classification of Soil Series - Big Horn County SSA-603 dated 1/82
- Pedon descriptions
- Soil map unit descriptions

Soil Descriptions, Hot Springs County SSA-617
Prepared by William Glenn under contract to BLM in 1990
Total Descriptions – 65
- SCS-232 descriptions
- Soil Series Comparison Sheets
- Soil Transect Data Sheets

Field Office Tech Guide (FOTG) for Big Horn County produced by NRCS dated 8/13/97. This data is contained in the Electronic Field Office Tech Guide (EFOTG) that is available on line.

Soil Maps on mylar orthophotoquads and topographic maps. Nothing available in digital format.

Park County

Original Soil Survey Field Handbook with the following documentation:

- Soil Survey Field Legend – Park County SSA-629 dated 2/89
- Classification of Soil Series - Park County SSA-629 dated 2/89
- Soil Survey Field Legend – Park County SSA-629 dated 3/82
- Pedon descriptions
- Soil map unit descriptions

Electronic Field Office Tech Guide (EFOTG) that is available on line.

Soil Maps on mylar orthophotoquads and topographic maps.

Digitized and attributed coverage for Cody Field Office:

-This product has been recently completed by the BLM Wyoming State Office but has not been reviewed for accuracy. Problems may exist, since it does not appear that provisions were made for county boundaries

-Polygons are not linked to an electronic data base.

BLM Wyoming notes by Alex Stum

August 26, 2003

- Soapholes Survey

  Supporting data was found behind field check notes for Big Piney/LeBarge survey. The data for the Soapholes survey includes field checks, pedon descriptions from 1992. They were done by JDM- probably John Macdonald.
- Sublette County, Folder #2 (yellow).

  There is a soil legend for surveys: *Burma Road, Soapholes, Big Piney/LeBarge, NRCS surveys*. This legend includes: Map symbol, Soil series name, % composition this soil makes of this map unit, Landform, slope, horizons and their texture, Hyd. Group, K, %K, pH, EC, SAR, Perm.

- Henry's Fork, SCS survey (1988) is located both Utah and Wyoming.

Questions: where are the areas under pressure to be developed in the Rawlins district? What is the existing coverage of the area?

August 28, 2003

Yesterday (8/27/2003) I e-mailed Bio-West to see if they could give me leads into their survey (Riley Ridge) and/or any information regarding Polk and Dern Resource Consultants and Texas Resource Consultants. George Dern was associated with the Texas Resource Consultants (letter from Linda M. Waring-Wilson, Contracting Officer, March 12,1982). This might shed some light on Platte and Overland surveys in the Rawlins district.

Today I e-mailed a representative of SaLUT, Prad Perera, asking if they housed any data from past survey SaLUT conducted.

Three Regional Categories

1) Areas where surveys are near completion or were started and appear incomplete
    1. Rock Creek
    2. Henry's Fork
    3. Sage Creek (SCS)
    4. Shirley Basin
    5. Big Horn River Basin (SCS), Park county, Big Horn county, Washakie county, Hot Springs county
    6. Buffalo (NRCS), in progress
    7. Pinedale (NRCS), in progress
    8. Mountain View/Bridger (NRCS), in progress

A. Virgin areas, unsurveyed or no known survey
    a. Northern Sweetwater county

B. Non-NRCS surveys, may need field checking, holes filled, lack data, updating, and their strengths and weaknesses identified.
    II. Texas Resource Consultants (TRC)
    a. Overland
    b. Platte
    III. SaLUT
    a. Grass Creek
    b. Green River

c. Salt Wells
d. Overland

IV. Bio-West (Riley Ridge)
V. Big Piney/LeBarge
VI. Cumberland
VII. 7 Lakes
VIII. Soapholes
IX. Burma Road
X. Big Sandy
XI. Smith's Fork
XII. Tri-Territories (Stagecoach Draw)

August 29, 2003

- I downloaded some digitized soil polygons from the Rawlins area but there is no way of telling where they are relative to Rawlins or anywhere. There are no political or physical features to identify where or what the polygons are overlaying. It is in "state plane" and "NAD 1927). I tried to overlay a map of Wyoming over it but they didn't match up. Perhaps they were in different units?

September 1, 2003

Shirley Basin and Mountain

I have populated the Shirley Basin and Mountain spreadsheet. There is not very much information on Shirley Mountain. It is nothing more than a detailed legend of map units (it has % of soil series components) and map unit descriptions which is labeled tentative. The Shirley Mountain survey is located within the Shirley Basin, just Southwest of the center of it. It is has the date 1/27/81.

Shirley Basin covers 916,000 acres of Northeastern Carbon county and Northwestern Albany county. Work appears to have been done primarily in 1984.

Shirley Basin components

1) Soil Classification table
2) 232's (1983 field season)
3) A detailed legend of Map Units
4) Legend of Map Unit components
5) Taxonomic unit list
6) Component list (has Map units that each soil series occurs in, # of descriptions made and needed for the soil series)
7) Rough hand written notes (appear to be field notes)
   a. Walker Draw NW
   b. TE Ranch
   c. Mossy Agate
   d. Bate Cr. Res.
8) Map unit descriptions (typed)
9) Soil lab results
10) Taxonomic legend of lab results

September 3-5, 2003

I have populated the Seven Lakes spread sheet. According to the descriptions of the Map unit locations it runs farther North than Richard Larson thought (according to a rough map of survey areas he compiled). It appears to cover Southeastern Freemont county up to the southern bank of the Sweetwater River, Northeastern Sweetwater county and Northwestern Carbon county. It appears to be useless and extremely broad in its descriptions. It is only classified to taxonomic sub-groups.

The Sage Creek survey is a SCS done in 1971. It covers 187,475 acres of south central Carbon County exclusively on the East side of the continental divide. It has 59 soil series and descriptions of their typical pedon. (See spread sheet for details).

The Overland survey by SaLUT covers 1,107,870.6 acres of Eastern Sweetwater and Southwestern Carbon counties. See spread sheet for further details.

Today (Friday, September 5, 2003) I called Bio-West here in Logan concerning the Riley Ridge Project. They still have record of it. The receptionist said she would look into it to see if they have anything beyond the published version. She will try to call back on Monday. Their phone # is 435-752-4202.

September 6-13, 2003

Evaluation Scoring

Some note and brain storming on how to evaluate these surveys

The idea of breaking it into three categories:

Attributes & Documentation
  II. Pedon Descriptions x Density
  III. Map Unit Description + Transect x Density
  IV. Time to complete (field seasons)
  V. Lab Data

e. Spatial Data
  2. Maps
    a. legend
    b. format
  3. Geo-referencing
    pedons
    transects
    map units

f. Qualitative
  - Age
  - Format
  - Components
    a. Interpretations
    b. Land Use

Formula

If there is sufficient data that has been gathered accurately and we can identify where it is accurately then the survey can be easily improved qualitatively; otherwise it is just Fluff and you can dress it up however you want. The interpretations drawn from it will be useless and undependable.

Spatial data points: SD_P and SD_{Ppos}

Attribute and Documentation points: AD_P and AD_{Ppos}

Qualitative points: Q_P and Q_{Ppos}

The Qualitative score (Q_S) is derived by the equation below. The quality of a survey is a product of its supporting data:

$$\left(\frac{Q_P}{Q_{Ppos}}\right) \times \left(\frac{SD_P}{SD_{Ppos}}\right) \times \left(\frac{AD_P}{AD_{Ppos}}\right) = Q_S$$

Spatial data score (SD_S): $\left(\frac{SD_P}{SD_{Ppos}}\right) = SD_S$

Attribute and Documentation score (AD_S): $\left(\frac{AD_P}{AD_{Ppos}}\right) = AD_S$

Obtaining the overall score: $\frac{SD_S \times AD_S + Q_S}{2} = Final$

We can give the survey two scores to reflect their status and their potential. The above formula would be a score that would reflect the status. The product of just SD_S and AD_S would be the potential score. The quality and the reliability of a survey can be improved so far as it has accurate data. That is why the quality score is product of all three. So if a survey receives all points possible for quality its quality score will only be as good as the data. This then could work the other way around. If the data exists and is reliable but the survey doesn't have all the points for quality they could be created from the data. Like land use interpretations, they can be created from good data.

The Awarding of Points with in Each Category

9. Attributes and Documentation

-Density could be classified as an attribute or spatial data. For our purposes it will categorized as an Attribute. Density will be used to describe the spatial distribution of pedons and transects over a component or map unit. The distribution of pedons and transects is a representation of how well a component or Map Unit have been attributed (described). How density and what it is describing will combined for a score will be worked out below.

A. Pedon Descriptions

Pedon descriptions should have at least the 15 following parts: horizon designation, texture, roots, pores, color, slope, aspect, elevation, consistence, pH, reaction, structure, drainage class, landform descriptors, and vegetation. So 15 points are possible. Also, there is a standard number of pedon descriptions needed per given component area in acres.

> Completely describe each component used in the map unit name. Record three complete pedon descriptions that represent the concept of the soil that is used as a map unit component before adding a taxonomic unit to the descriptive legend as approved. This documentation is adequate for the correlation of established soil series

> or higher taxonomic categories, which commonly are used to name map unit components that are less than 1000 acres in extent. Add one additional pedon description per 3,000 acres for soil map unit components that are 1,000 to 10,000 acres in extent. Add one additional pedon description for each additional 10,000 acres of a soil map unit component surveyed. Pedon descriptions may be from transects within the named soil map unit component. Adequately describe all additional components to show the differences from the primary components. The documentation primarily comes from transects. (From the *National Soil Surveying Handbook*, section 627-08 d.2.i.; emphasis added by underlining.)

Pedon description score will be out of 15 points possible: $\frac{Points}{15} = score$

The density score will be the number of descriptions over the number needed for the components size:

0-999 acres = 3; 1,000-3,999 acres = 4; 4,000-6,999 = 5; 7,000-9,999 = 6;
10,000-19,999 = 7; 20,000-29,999 = 8

Excel spreadsheet heading for pedon scoring

Component name	Elements missing	Pedon points	Pedon score	Acres of component	number of descriptions	score (#description/req.#)	Overall score	# of descriptions still needed

Elements missing: will list the parts of the pedon description that are missing.
Key to missing elements: (H) - horizon designation, (T) - texture, (R) - roots, (P) - pores, (C) - color, (S) - slope, (A) - aspect, (E) elevation, (Cs) - consistence, (pH) - pH, (Re) - reaction, (St) - structure, (D) - drainage class, (L) landform descriptors, and (V) vegetation

Pedon Points: the points a description receives based on having the 15 elements of a description.

Score (#description / req. #): the score for density of descriptions.

Overall score: the overall score is the product of the *pedon score* x *density score*. How well a component (polygon) has been mapped is a product of how well it was described over the entire area.

A. If a pedon score is low then the existing data isn't very reliable. If the density score is low more pedon descriptions should be made.

B. Map Unit Description

Map units and their distribution of components is determined by: 1) defining the range in landscape features (slope, climate, vegetation, & landform) and 2) running transects. A problem with transect data is that it is almost never present in the final product. Nor does the NRCS enter transect data into NASIS unless a transect point is going to be used as a pedon description to correlate a component. As a result transect data is often not to be found. Due to this, a score that is a product of the map unit description, transect description and transect density will not used. Map unit description score (MUD) will be treated separately from transects; though ideally they should not be. They will then be added together and averaged:

$$\frac{MUD_{Score} + Tran_{Score}}{2} = TotalScore$$

- Map unit descriptions need the following to receive full marks: climate, range type (vegetation, etc.), landform, slope, and component break down (50% of A, 30% of B, 20% other). Each will be weighted equally for a total of five points. The score will be the actual points received over five points.

$$\frac{MapUnitDescriptionPo\operatorname{int}s}{5Po\operatorname{int}sPossible} = MUD_{Score}$$

- Transects should have the 11 elements to their description horizon designation: texture, color, slope, aspect, elevation, consistence, pH, reaction, drainage class, landform descriptors, and vegetation.

$$\frac{Tran\sec tElements}{11\mathrm{Re}quired} \times \frac{Tran\sec tPo\operatorname{int}s}{Po\operatorname{int}s\,\mathrm{Re}quired} = Tran_{Score}$$

This allows a survey can receive a maximum score of .5 or 50% of the points possible in this category if no transect data can be found.

II. Spatial Data

-points for pedons being labeled on map or orthophoto.

III. Qualitative

The Age: the era in which the survey was completed should reflect which version of "Soil Taxonomy" that was used. 1983, the first of edition of *Key to Soil Taxonomy* came out. Surveys before 1975 were done before the release of *Soil Taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys.*

Pre-1975 "0"; 1975-1982 "1"; 1982-1992 "2"; 1992-present "3".

The age of a survey is part of the qualitative score. I felt that it would fit best in this category as classifications from older versions could be translated into newer versions of taxonomy and classifications are products of your data (the observations from the landscape and pedons).

December 4, 2003

The scoring of the surveys is likely to show most of the surveys as lacking supporting data. This may not be because it never was obtained to create the survey but I have no record of it. If more is found to exist later it simply can be added to the tally for its respective unit (be it map unit or soil series).

Appendix D. Slope Analysis for Digitized Portions of Carbon County Soil Survey

A Test of Soil Map Unit Accuracy

Soil Surveys are an important reference for land managers to understand the soils. In the West there are large tracts of land that do not have adequate soil data for all the planning and activities performed by land managers like the BLM. Those that do exist are of questionable quality. These soil surveys often cover huge tracts of territory and were mapped in perhaps too short of time with too few resources.

Over a landscape there is a great deal of variation in the soils that are under your feet. General soil types are lumped together into artificial categories called map units. They often contain soils that have similar properties (association) or distinct soil types that are intermingled (complexes). When you open a soil survey often you turn to the soil map to find out the soils of a location. The map units are shown as polygons on the map with a symbol that refers you to the description of that soil. This description may include such characteristics as: climate, slope, vegetation, land use, typical pedon description (morphological characters of the soil profile), landform, etc. This brings up a critical question; is the soil really what the map says it is?

Variability in soil characteristics within a map unit A range of expected soil characteristics is given for each map unit; nevertheless a soil may lie outside that range. No survey is likely to be perfect and can therefore be improved. To assess existing soil surveys can take a great deal of resources to verify and remap these surveys. GIS and Remote Sensing technologies can be used to identify potential problems and errors in previously mapped areas, thus focusing the effort.

Slope is an important characteristic in soil formation and land management planning. It is also relatively easy to check using GIS. Portions of Carbon County soil surveys have been digitized. Using the digitized soils of Carbon County I was able to demonstrate how this can work (see figure 4.). I attributed the soil coverage with the minimum and maximum slope range from the map unit description. This was done joining the data from an external database (Access data base). I then selected all soil polygons whose maximum slope value was equal to 10%. Using slope map derived from a 30 m digital elevation model (DEM) (figure 4), I ran a query to select all slopes greater than 10% (see figures 5a. and 5b.). Figure 6 is a histogram of 30m pixels within the soil polygons that had slopes >10%. This showed that 205,378 of the 1,159,800 cells that made up these map unit polygons (map units with a maximum slope of 10%) overlapped areas of slope greater than their maximum slope range. This is 17.7% of the area which is outside of their specified slope range. This is not including how much may be outside the minimum. This process can then be iterated for each maximum and minimum value of slope.

It can be expected that some areas will be outside of the range of characteristics. Also, slopes on the ground may differ from the DEM slope map, due to imperfections in the DEM and resolution not capturing all the variability. Nevertheless, this exercise demonstrates that significant area is likely outside the range of the reported slope. These errors may be from digitizing of soil maps, errors in the original mapping and delineating of polygons, or map unit concepts need to be revised.

Figures

Figure 4: soil map coverage of Carbon County over the 30 m slope DEM.

Figure 5a: soil polygons (blue) which have a maximum slope of 10%; Red, pixels whose slope is greater than 10%.

Figure 6: histogram of pixels with slope less than 10% (blue) and greater than 10% (red) within map units with a maximum slope of 10%.

Technical Notes:

I first had to obtain the digitized soil map of Carbon County and the DEM's that overlapped all of the digitized soil survey. The soil map came in individual quads which had to be mosaiced into one soil map. Map units had to be merged quad boundaries cutting polygons dissolved. This was done using the geo-processing wizard. I also had to add on the maximum and minimum slope values the attribute table. The data came from an access file data base which had to be converted into an excel database and then to tab delimited text so it could be imported into ArcView as a table and then joined to the soil shape file called "car_merge.shp."

The area of interest required nine 30m DEMs which needed to be mosaiced into one. In ArcINFO, I first tried "latticemerge" but the cell sizes were all slightly different. To avoid resampling all nine I tried "mosaic" but this left large suture marks. I then used "gridedit" in Grid. Using the “gridmerge” command I put them together. This yielded a slightly better product which I used. I then ran "slope" in Grid. Since I am only interested in interger values of slope and to expedite the process I turned the floating grid into an integer grid using the "int" command. I also clipped the grid with the soil polygon coverage (I converted "car_merge.shp" into a coverage, see figure 4.).

I was hoping to run a map query in ArcView but realized that this would not work. I also tried to convert the intger slope grid into a polygon coverage (gridpoly) but it was too large and the computer refused. Instead I ran a query in the polygon attribute table (PAT): “([high_slope]="10")” high_slope is the field with the maximum slope. I then converted selected polygons into a shapefile. I then ran map query for the slope grid: ”[Int_slope]>10.AsGrid” this found all slope values greater than 10%(see figures 5a. and 5b.). I then used "Histogram By Zone" with the newly created shape file of polygons with a maximum slope of 10% selected in the legend. I selected "high_slope" as the category and selected all zones within the "Map Query 1" which is all slopes greater than 10% (see figure 6.).

A more efficient method would be to convert the polygons to a raster, assigned the value of the maximum slope = MU_maxslope. Then Where Slope > MU_maxslope = 1 and 0 otherwise. All areas greater than the stated slope range would receive a value of 1 and could be easily summarized.

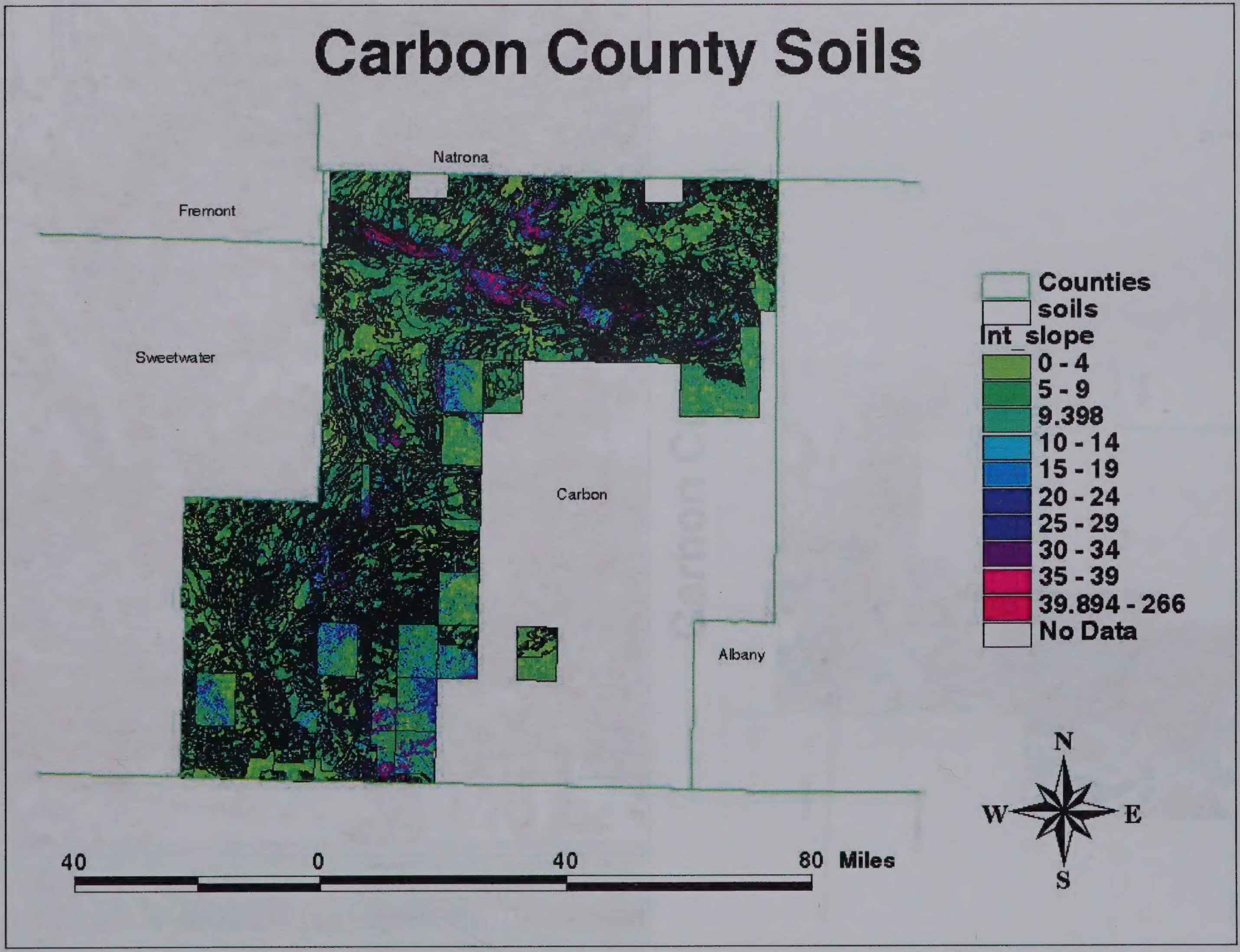

Figure 4. Soil map coverage of Carbon County over the 30-m slope DEM.

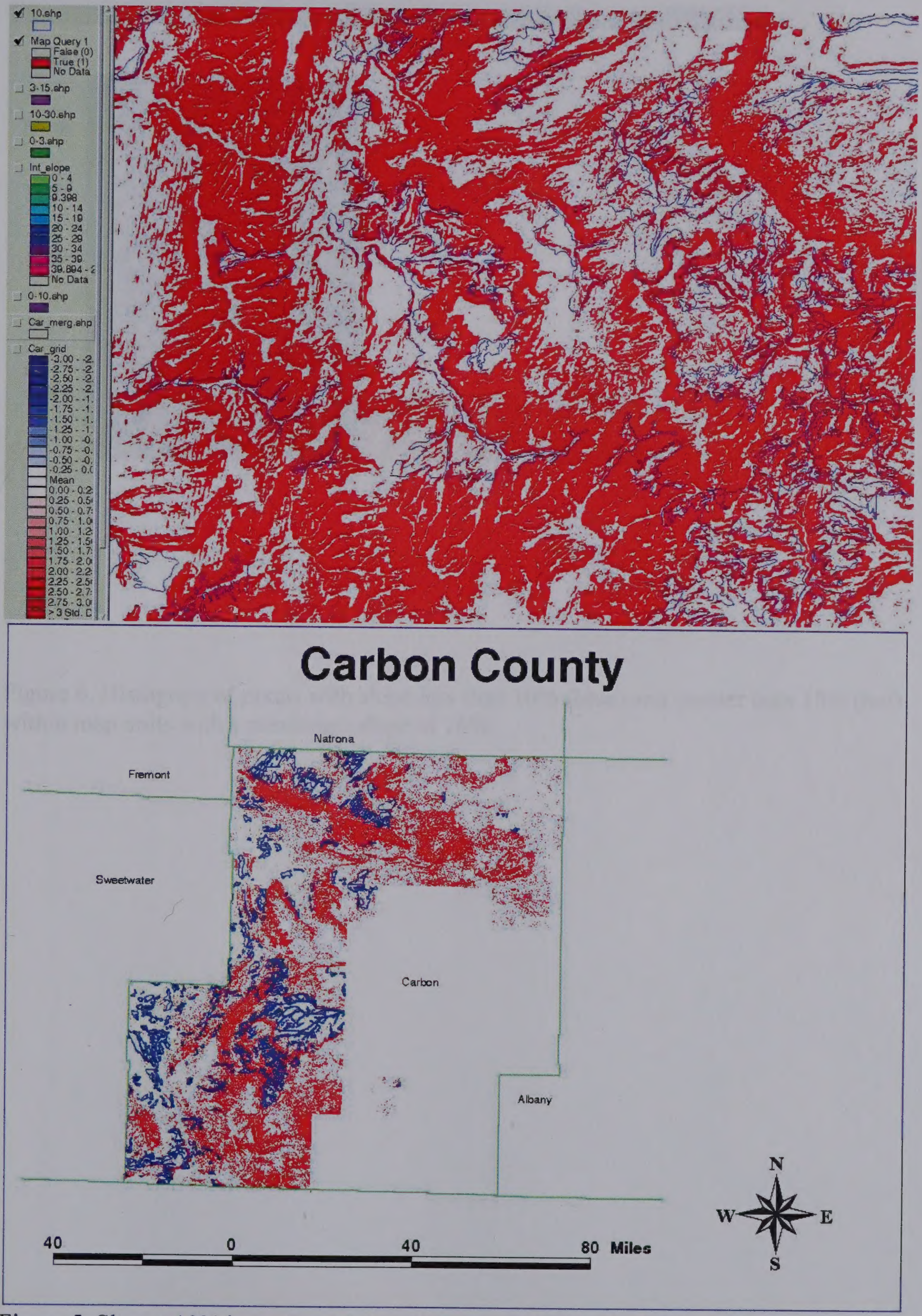

Figure 5. Slope >10% in section of area (top; a), and in whole digitized area (bottom;b).

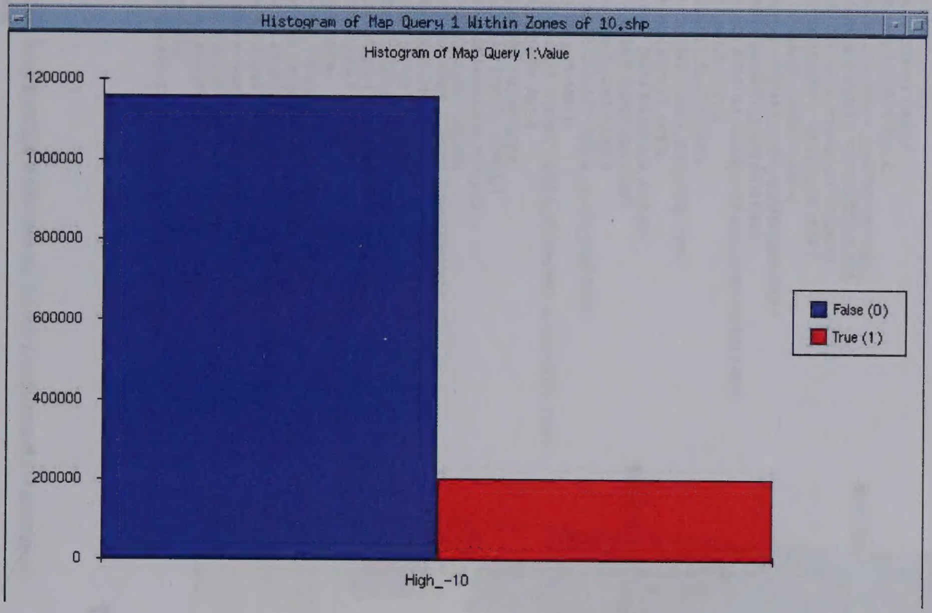

Figure 6. Histogram of pixels with slope less than 10% (blue) and greater than 10% (red) within map units with a maximum slope of 10%.

Figure 1. Index Map of all surveys scored

BLM Contract Surveys

1 Rock Creek
2 Grass Creek (Hot Springs County)
3 Seven Lakes
4 Overland (SaLUT)
5 Overland (TRC)
6 Shirley Basin
7 Sage Creek
8 Red Rim & other small surveys
9 Encampment
10 Salt Wells
11 Green River
12 Riley Ridge (Bio-West)
13 Cummberland
14 Soapholes
15 Big Piney/LeBarge
16 Burma Road
17 Tri-Territories
18 Smith's Fork

WY011	CROOK COUNTY
WY027	NIOBRARA COUNTY
WY031	PLATTE COUNTY
WY041	UINTA COUNTY AREA
WY043	WASHAKIE COUNTY
WY045	WESTON COUNTY
WY601	ALBANY COUNTY AREA
WY603	BIG HORN COUNTY AREA
WY605	CAMPBELL COUNTY, SOUTHERN PART
WY609	CONVERSE COUNTY, SOUTHERN PART
WY613	RIVERTON AREA, FREMONT COUNTY
WY615	GOSHEN COUNTY, SOUTHERN PART
WY617	HOT SPRINGS COUNTY AREA
WY619	JOHNSON COUNTY AREA, SOUTHERN PART
WY621	LARAMIE COUNTY, EASTERN PART
WY622	MEDICINE BOW NATIONAL FOREST, NORTHERN PART
WY623	STAR VALLEY AREA
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WY635	SUBLETTE COUNTY AREA, SOUTHERN PART
WY636	EDEN VALLEY AREA
WY637	SWEETWATER COUNTY AREA, WYOMING, NORTHERN PART
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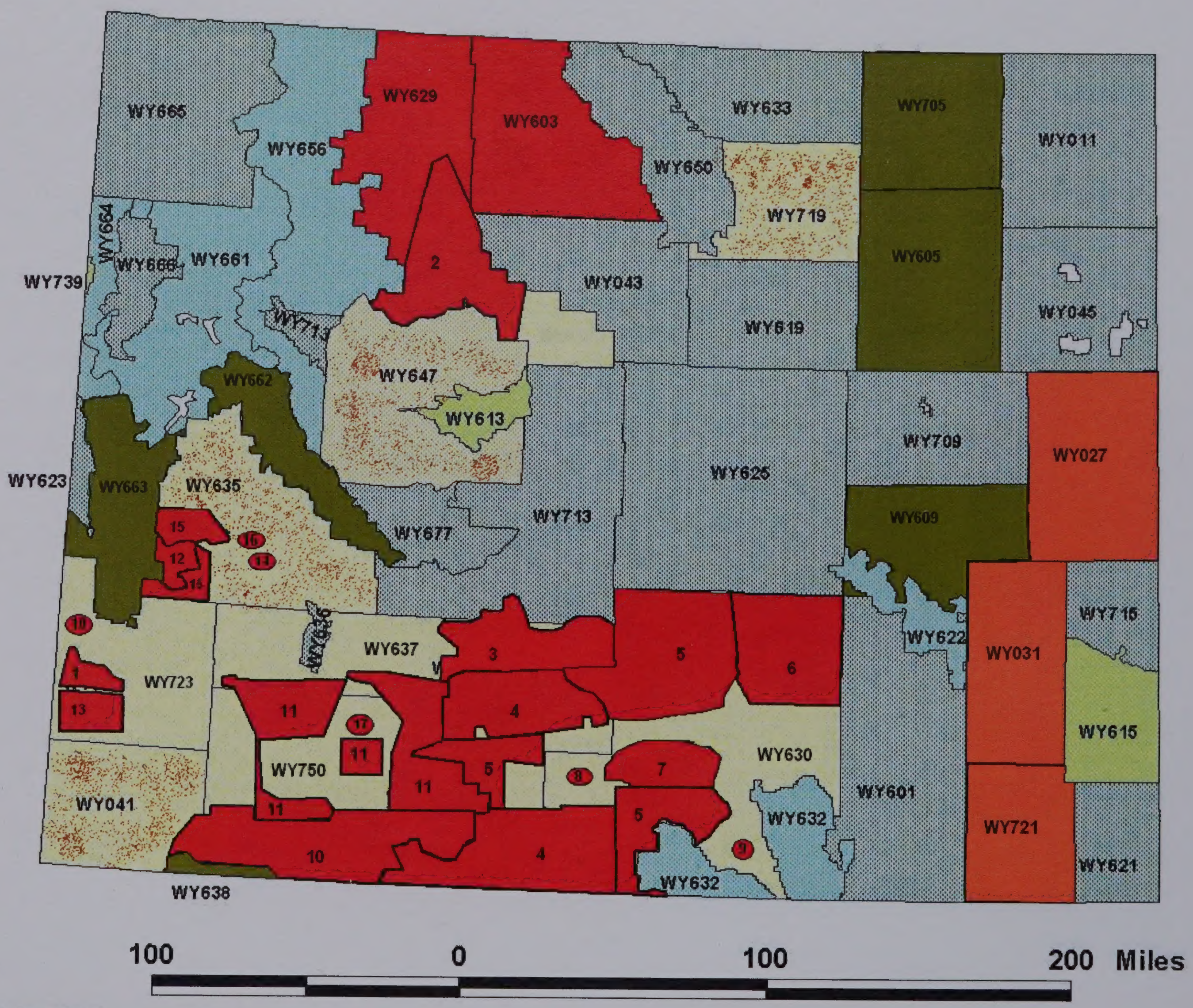
WY739	TETON AREA
WY750	SWEETWATER COUNTY AREA, SOUTHERN PART

BLM Contract Survey

Index Map



Status

- ▨ Incomplete Soil Surveys Available for Some Locations-No Publication
- 🟧 & ▨ Published
- ■ Soil Survey Complete - Publication Underway
- ▨ Soil Survey Complete -No Publication Planned
- ☐ Soil Survey Not Completed
- ▨ Soil Survey Underway
- ▨ Update Needed
- 🟥 BLM Contract Surveys & Other Surveys Evaluated

Underlying map coverage was a jpeg image from Wyoming NRCS web page: http://www.wy.nrcs.usda.gov/technical/wysoils/map.jpg Modified February 28, 2004; showing BLM contract surveys.

N
W E
S

Figure 2. Data Quality for all surveys scored

BLM Contract Surveys

1 Rock Creek
2 Grass Creek (Hot Springs County)
3 Seven Lakes
4 Overland (SaLUT)
5 Overland (TRC)
6 Shirley Basin
7 Sage Creek
8 Red Rim & other small surveys
9 Encampment
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11 Green River
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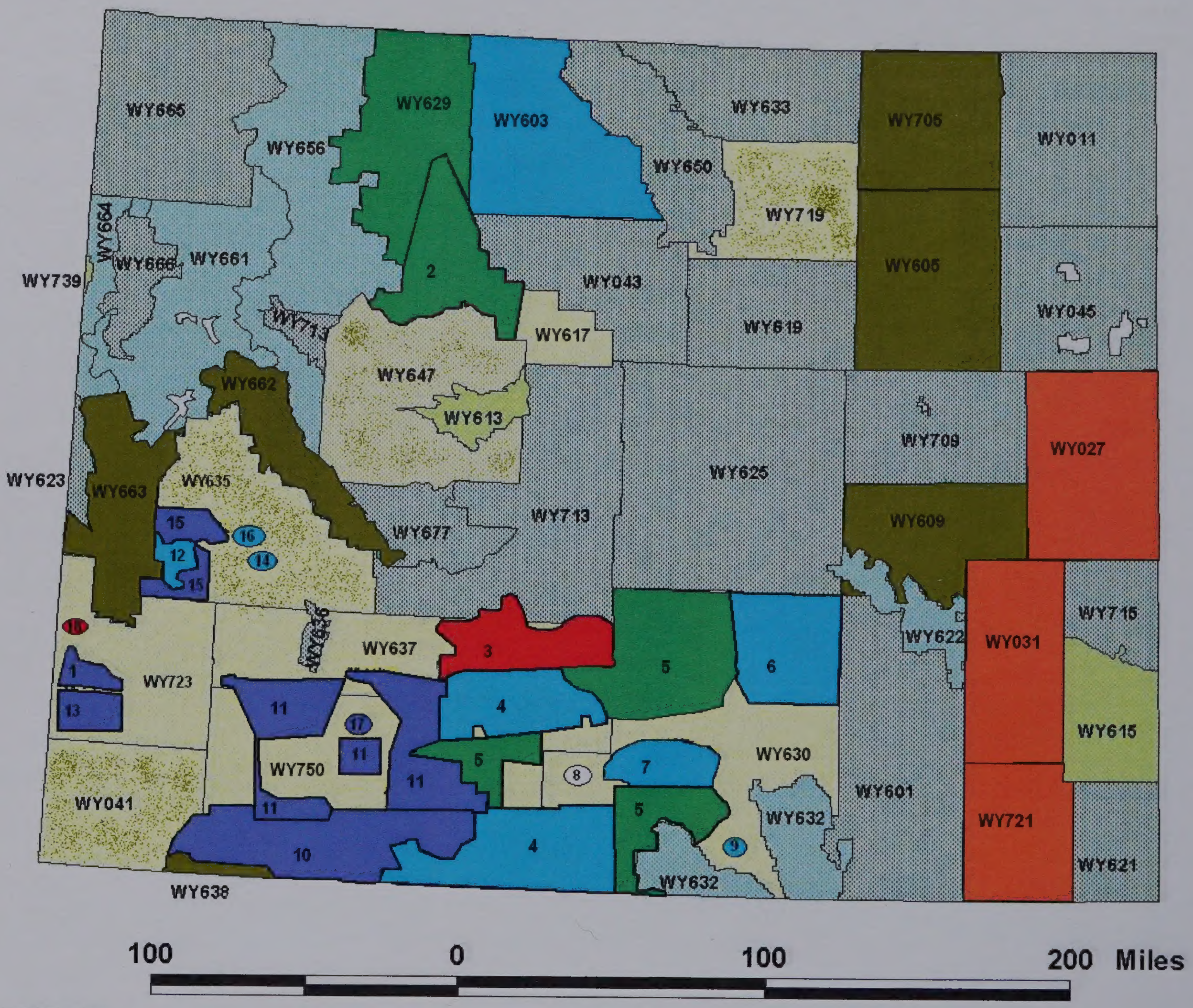
Index Map to Contract Surveys

Data Quality Score



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- 🟩 **Contract Surveys that scored: 0.50+**
- 🟦 **Contract Surveys that scored: 0.40- <0.50**
- 🟦 **Contract Surveys that scored: 0.30- <0.40**
- 🟥 **Contract Surveys that scored: 0.10- 0.30**

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W E
S

Figure 3. Overall quality for all surveys scored

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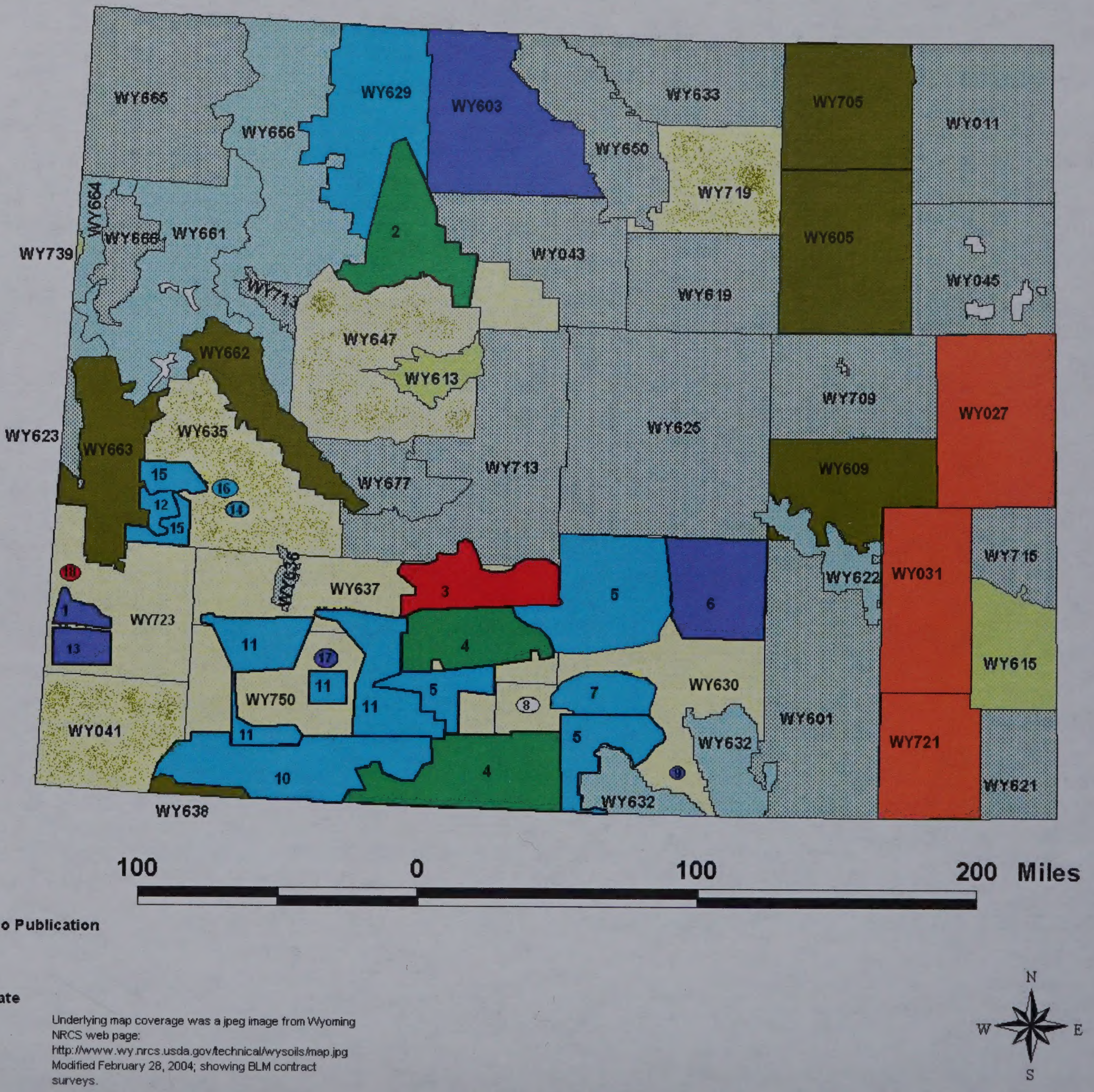
Overall Scores



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Utah State
UNIVERSITY

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July 31, 2006

Rick Schuler, Project Investigator
USDI Bureau of Land Management
Wyoming State Office
PO Box 1828
Cheyenne, WY 82009

Dear Rick:

Enclosed please the final report for Phases I, II, and III of the project, Cooperative Agreement No. JSA001015 Task Order No. 8 "Accelerating Soil Survey of Wyoming Public Lands: Developing Protocols and Methodology for Inventory and Data Quality Assessment." Soft-bound hard copies and electronic copies (pdf format on the enclosed CD) are provided.

The final report for Phase I is in the form of the 2004 MS thesis by Nephi J. Cole, "A Pedogenic Understanding Raster Classification Model for Mapping Soils, Powder River, Wyoming." Electronic (pdf) copies were sent to you and Bill Ypsilantis (NSTC, Denver, CO) as a WinZip archive attached to an e-mail dated March 7, 2006, and re-sent as pdf attachments to several e-mail messages on March 24, 2006.

The final report for Phase II is in the form of the 2005 MS thesis by Amy M. Saunders, "Incorporating Classification Tree Analysis into the Pedogenic Understanding Raster Classification Methodology, Green River Basin, Wyoming." Electronic (pdf) copies were sent to you and Bill Ypsilantis as a WinZip archive attached to an e-mail message on March 7, 2006.

The final report for Phase III is labeled as such. A pdf copy was sent as an e-mail attachment to you and Bill Ypsilantis on March 23, 2006. Following our teleconference, we corrected the omission of a soil survey area in the index maps, and added a new appendix describing a study by Alex Stum to evaluate slope of digitized soil survey data for Carbon County. A copy of the updated report was sent as an e-mail attachment July 30, 2006.

All spatially explicit data layers (raw, pre-processed, processed, and final) from Phase I and II are archived at Utah State University. As we agreed during the March 24 teleconference, these data will be archived indefinitely at USU, and is available to the BLM and others upon request.

In addition to the work presented in the final report, Nephi Cole and I have been extensively involved in technology transfer and training, Nephi and I were members of the cadre that developed and taught Course 7000-05, "Advanced Technology in Soil Mapping, offered by the

BLM National Training Center in 2004." Nephi and I presented a poster at the BLM National Soil-Water-Air (SWA) Conference in February 2006. We also developed and delivered two 1-hr hands-on training modules on the Pedogenic Understanding Raster Classification (PURC) Method for participants of the SWA Conference. The training modules (PowerPoint files) were sent as e-mail attachments on March 13, 2006. These modules and example data layers are also archived at USU and available upon request.

My graduate students and I have been active in reporting our findings from this project to the scientific community. Two manuscripts from Phases I and II will be published in November 2006 by Elsevier as Chapters 27 and 28 in Developments in Soil Science, Volume 31: Digital Soil Mapping: An Introductory Perspective, edited by P. Lagacherie, A.B. McBratney and M. Voltz. Corrected proofs were sent as e-mail attachments to you and Bill Ypsilantis on July 31, 2006. I will send electronic and hard copies of the papers upon final publication. The citations for these and the abstracts of public presentations are listed below (underlined names indicate students):

Cole, N.J., and J.L. Boettinger. 2006. A Pedogenic Understanding Raster Classification Methodology for Mapping Soils, Powder River Basin, Wyoming, USA. Chapter 27 In: P. Lagacherie, A.B. McBratney and M. Voltz (eds.) Digital Soil Mapping, An Introductory Perspective. Developments in Soil Science Series 31:389-400. Elsevier, Amsterdam. (*Forthcoming, November 2006*).

Saunders, A.M., and J.L. Boettinger. 2006. Incorporating Classification Trees into a Pedogenic Understanding Raster Classification Methodology, Green River Basin, Wyoming, USA. Chapter 28 In: P. Lagacherie, A.B. McBratney and M. Voltz (eds.) Digital Soil Mapping, An Introductory Perspective. Developments in Soil Science Series 31:401-411. Elsevier, Amsterdam. (*Forthcoming, November 2006*).

Boettinger, J.L., N.J. Cole, A.M. Saunders, S.J. Nield, S. Kienast-Brown, J.M. Bodily, and A.K. Stum. 2006. Refining the Pedogenic Understanding Raster Classification Methodology.

Boettinger, J.L., J.M. Bodily, N.J. Cole, S. Kienast-Brown, S.J. Nield, A.M. Saunders, A.K. Stum, and R.D. Ramsey. 2006. Landsat Spectral Data for Digital Soil Mapping. Second Global Digital Soil Mapping Workshop. Rio de Janeiro, Brazil, July 2006.

N.J. Cole, A.M. Saunders, J.L. Boettinger, and R.D. Ramsey. 2006. PURC: The Digital Methodology for Mapping Soils. Spring Runoff Conference, USU Water Initiative, Logan, UT, March 2006.

Saunders, A.M., J.L. Boettinger, and R.D. Ramsey. 2005. Classification Tree Analysis for Predicting Soil Distribution on Public Lands, Green River Basin, Wyoming. *Soil Science Society of America 69th Annual Meeting*, Salt Lake City, UT. Nov. 6-10, 2005.

Saunders, A.M., and J.L. Boettinger. 2005. Incorporating Classification Trees into a Pedogenic Understanding Raster Classification Methodology, Green River Basin, Wyoming. Western Society of Soil Science and the American Association for the Advancement of Science-Pacific Division Annual Meetings, June 13, 2005, Ashland Oregon.

Cole, N.J., and J.L. Boettinger. Pedogenic Understanding Raster-Based Classification Methodology for Mapping Soils, Powder River Basin, Wyoming. Global Workshop on Digital Soil Mapping, September 14-17, 2004, Montpellier, France.

Saunders, A.M., and J.L. Boettinger. Adaptation and Transfer of Pedogenic Understanding Raster-Based Classification Methodology for Mapping Soils. Global Workshop on Digital Soil Mapping, September 14-17, 2004, Montpellier, France.

Cole, N.J., and J.L. Boettinger. 2003. Mapping soils using unsupervised, supervised, and knowledge-based classification models, Powder River Basin, WY. Abstract of Technical Presentation, ESRI Southwest User Group (SWUG) Conference, Jackson, WY, October 29, 2003.

Cole, N.J., and J.L. Boettinger. 2003. Unsupervised, supervised, and knowledge-based classification models for mapping soils, Powder River Basin, WY. ASA-CSA-SSSA Abstracts, Madison, WI.

I am sincerely grateful for the financial support and the opportunity to undertake this novel project. The research conducted for Phases I and II became two critical steps leading to new investment to incorporate remote sensing and quantitative modeling of spatial data into the National Cooperative Soil Survey.

If you have any questions or need more information, please do not hesitate to contact me.

Best regards,

Janis

Janis L. Boettinger
Associate Professor of Pedology

Cc: Bill Ypsilantis, NSTC

Enclosures